

# Warsaw Green City and Climate Action Plan

Annex to Resolution No. LXXX/2648/2023 Council of the Capital City of Warsaw from 20th April 2023 on adoption of the "Green City & Climate Action Plan".

Green City & Climate Action Plan

Final edit | February 2023



Photo: City of Warsaw

As part of the program:



Warsaw

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European Bank  
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## Foreword from the Mayor of the City of Warsaw

**The role of cities in the implementation of global climate policy is absolutely crucial due to the level of greenhouse gas emissions associated with their operation. With this in mind, and in order to develop in a sustainable manner, the city of Warsaw has declared targets to reduce these emissions: 40% by 2030 and to achieve climate neutrality no later than 2050.**

We, Cities, are in the frontline of the climate crisis. We must make valiant decisions. Our ambitions are lofty. To identify and demonstrate our potential, we have set an additional extended target of around 60% reduction in emissions by 2030. We recognise that significant barriers must be overcome to achieve this. We presented an extended scenario to show how this can be achieved with the proper external conditions.

The answer to this challenge is the Green City and Climate Action Plan of Warsaw. This study establishes new climate objectives for the City of Warsaw. It sets out directions for the city's development and at the same time indicates specific actions whose implementation will bring us closer to achieving climate neutrality.

The document has been designed in such a way that both the long-term goals and the accompanying measures are ambitious, but also feasible to implement.

I thank the TaiwanBusiness - EBRD Technical Cooperation Fund and the Ministry of Finance who, in cooperation with the European Bank for Reconstruction and Development, decided to finance the preparation of the Green City and Climate Action Plan of Warsaw, and to C40 cities for its extensive support in developing the climate side of this document.

I am convinced that the implementation of Green City and Climate Action Plan of Warsaw, as well as the planning of the work of municipal units with particular emphasis on the indicated directions, will help the City of Warsaw achieve its objectives. The realisation of this Vision will not succeed without your participation. Let us care for our city, for each other, and let our everyday choices influence its further sustainable development towards zero-carbon.

**Rafał Trzaskowski**

**Mayor of the City of Warsaw**



Photo: City of Warsaw

# The Green City and Climate Action Plan and the city strategies

## Document status

The Green City and Climate Action Plan of Warsaw ('GCCAP' or 'Road map') aims to support the city in its pursuit of climate neutrality and resilience. This document is based on the city's declared levels of reduction in greenhouse gas emissions and its declaration to strive for climate neutrality. The Green City and Climate Action Plan of Warsaw promotes the achievement of sustainable development objectives whilst supporting social inclusion.

Referring to the Mayor's Resolution on the introduction of standards for programming documents for the development of the City of Warsaw (Order No. 1868/2017 of 5 December 2017), it should be noted that the GCCAP is not a document programming the development of the City of Warsaw. It presents instead scenarios of actions to be implemented in order to meet the commitments made by the Mayor. These concern reducing greenhouse gases by 40% by 2030 and achieving climate neutrality by 2050 at the latest.

The starting point for realising the chosen climate scenario (30-year perspective) are the proposed measures that can be implemented in the next 5 to 10 years. These actions and the directions they set should be understood as an inspiration for the city and municipal entities and as an incentive to take steps that will start real change for the good of the climate and the natural environment. The transition represents real social and economic benefits for residents.

The document is approved by the City Council, which is regulated by the City Mayor's ordinance no. 4392/2010 of March 31st, 2010 on draft resolutions of the Council of the Capital City of Warsaw and ordinances of the Mayor of the Capital City of Warsaw.

**Road map (GCCAP)**      **A document containing proposed solutions (in the Green City and Climate Action Plan of Warsaw - in terms of moving towards climate neutrality).**



Photo: City of Warsaw

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## Acronyms and definitions

### Acronyms

ATMS	Advanced traffic management system	C40	C40 Cities Climate Leadership Group	HVAC	Heating, ventilation, air conditioning
BEI	Baseline emission inventory	EBI	European Investment Bank		Sanitary engineering branch dealing with: heating ventilation, air conditioning
BMS	Building management system	EBOR	European Bank for Reconstruction and Development	IPCC	Intergovernmental Panel on Climate Change
BGI	Blue-green infrastructure	ESCO	Energy Services Company		
BOD	Biological oxygen demand	GCAP	Green City Action Plan	IT	Information Technology
CAP	City Action Plan			ITS	Intelligent Transportation Systems
CHP	Combined Heat and Power	GCCAP	Green City and Climate Action Plan		
		GCoM	Global Covenant of Mayors for Climate & Energy	IEP-NRI	Institute of Environmental Protection – National Research Institute (in Polish: <i>IOŚ-PIB Instytut Ochrony Środowiska - Państwowy Instytut Badawczy</i> )
CIRIS	City Inventory Reporting and Information System	GIS	Chief Sanitary Inspector (in Polish: <i>Główny Inspektorat Sanitarny</i> )		
		GPC	Global Protocol for Cities	JST	Local government units (in Polish: <i>Jednostki samorządu terytorialnego</i> )
CNG	Compressed natural gas	GWh	Gigawatt hour		
CO <sub>2</sub>	Carbon dioxide	GHG	Greenhouse gas	KM	Masovian Railways
				KOBIZE	National Centre for Emissions Management (in Polish: <i>Krajowy Ośrodek Bilansowania i Zarządzania Emisjami</i> )
				LPG	Liquefied petroleum gas

## Acronyms and definitions

### Acronyms

MaaS	Mobility as a Service	NFOŚiGW	National Fund for Environmental Protection and Water Management (in Polish: <i>Narodowy Fundusz Ochrony Środowiska i Gospodarki Wodnej</i> )	PGN	Low-carbon economy Action Plan for Warsaw (in Polish: <i>Plan Gospodarki Niskoemisyjnej</i> )
tCO <sub>2</sub> e	Tonnes of carbon dioxide equivalent	NIK	Supreme Audit Office (in Polish: <i>Najwyższa Izba Kontroli</i> )	PGW WP	National Water Management Authority (in Polish: <i>Państwowe Gospodarstwo Wodne Wody Polskie</i> )
MPSZOK	Mobile selective municipal waste collection points (in Polish: <i>Mobilne punkty selektywnego zbierania odpadów komunalnych</i> )	NZEB	Net Zero Energy Building	PKP	Polish national railways (in Polish: <i>Polskie Koleje Państwowe S.A.</i> )
MPO	Municipal Cleaning Company (in Polish: <i>Miejskie Przedsiębiorstwo Oczyszczania w m.st. Warszawie sp. z o.o.</i> )	NGOs	Non Governmental Organizations	PM <sub>2,5</sub>	Particulate matter less than 2,5 µm in size
MPWiK	Municipal Water and Sewerage Company (in Polish: <i>Miejskie Przedsiębiorstwo Wodociągów i Kanalizacji w m.st. Warszawie S.A.</i> )	NH <sub>4</sub> <sup>+</sup>	Ammonium	PM <sub>10</sub>	Particulate matter less than 10 µm in size
MPZP	Local spatial development plan (in Polish: <i>Miejscowy plan zagospodarowania przestrzennego</i> )	NO <sub>x</sub>	Nitrogen oxides	PMŚ	State Environmental Monitoring (in Polish: <i>Państwowy Monitoring Środowiska</i> )
MW	Megawatt	RES	Renewable energy sources	PolSEFF	Polish Sustainable Energy Financing Facility
UHI	Urban Heat Island	BAZ	Biologically Active Zone	PPP	Public-private partnership
MWh	Megawatt hour	GDP	Gross domestic product	PSE	Polish Power System (in Polish: <i>Polskie Sieci Elektroenergetyczne S.A.</i> )
MZA	Municipal Bus Company (in Polish: <i>Miejskie Zakłady Autobusowe Sp. z o.o.</i> )	PGE	Polish Energy Group (in Polish: <i>Polska Grupa Energetyczna S.A.</i> )	PSZOK	Separate collection points for municipal waste (in Polish: <i>Punkty selektywnej zbiórki odpadów komunalnych</i> )
NBS	Nature-Based Solutions	PGNiG	Polish Oil and Gas Mining (in Polish: <i>Polskie Górnictwo Naftowe i Gazownictwo S.A.</i> )	PV	Photovoltaics
		PGNiG	Polish Oil and Gas Mining – Thermal (in Polish: <i>Polskie Górnictwo Naftowe i Gazownictwo Termika S.A.</i> )		

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## Acronyms and definitions

### Acronyms

PZUM	Platform of Integrated Mobility Services (in Polish: <i>Platforma zintegrowanych usług mobilności</i> )	EU	European Union
RVA	Risk and Vulnerability Assessment	URE	Energy Regulatory Office (in Polish: <i>Urząd Regulacji Energetyki</i> )
RDF	Refuse-derived fuel	WKD	Warsaw Commuter Railway (in Polish: <i>Warszawskie Koleje Dojazdowe</i> )
CTZ	Clean Transport Zones	WFOŚiGW	Regional Fund for Environmental Protection and Water Management (in Polish: <i>Wojewódzki Fundusz Ochrony Środowiska i Gospodarki Wodnej</i> )
SEAP	Sustainable Energy Action Plan	ZDM	Municipal Roads Authority (in Polish: <i>Zarząd Dróg Miejskich</i> )
SECAP	Sustainable Energy and Climate Action Plan	ZTM	Public Transport Authority (in Polish: <i>Zarząd Transportu Miejskiego w Warszawie</i> )
SO <sub>2</sub>	Sulphur dioxide	ZZW	The Greenery Management of the Capital City of Warsaw (in Polish: <i>Zarząd Zieleni m.st. Warszawy</i> )
SWOT	Strengths, Weaknesses, Opportunities Threats		
SUiKZP	Study of the conditions and directions of spatial development (in Polish: <i>Studium uwarunkowań i kierunków zagospodarowania przestrzennego</i> )		
TOD	Transit oriented development		

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## Acronyms and definitions

### Definitions

Zero-emission bus	Bus/trolleybus that uses electricity for propulsion, including energy generated from hydrogen in fuel cells installed in them, or only an engine whose duty cycle does not emit greenhouse gases or other substances covered by the emission management system for greenhouse gases and other substances (according to <i>Act of 11 January 2018 on electromobility and alternative fuels – Dz. U. [Journal of Laws] of 2018, item 317</i> ).	Blue-green infrastructure	A strategically planned network of natural and semi-natural areas with other environmental features, designed and managed to provide a wide range of ecosystem services (according to Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions Green Infrastructure (GI) — Enhancing Europe’s Natural Capital /COM/2013/0249)	EV2Grid	Vehicle-to-grid – a system allowing bi-directional energy flow between an electric (or hybrid) vehicle and the electricity grid
Low-emission bus	Bus/trolleybus powered by alternative fuels, allowing to reduce the emission of transport, which include, among others: hybrid buses, buses powered by: liquid biofuels, synthetic fuels, paraffin fuels, compressed natural gas (CNG), liquefied natural gas (LNG), gas from biomethane, liquefied petroleum gas (LPG).	ESCO formula	Energy Saving Company. An investment implementation formula aimed at introducing permanent energy savings in a company through measures taken in cooperation with a contractor specialising in energy services.	Forest land	Land: <ol style="list-style-type: none"><li>1) defined as forests in forest laws;</li><li>2) reclaimed for forest management purposes;</li><li>3) under access roads to forest land (according to <i>Act of 3 February 1995 on the protection of agricultural and forest land – Dz. U. [Journal of Laws] of 1995, No. 16, item 78</i>).</li></ol>



# Acronyms and definitions

## Definitions

Agricultural land	Land: 1) defined in the land register as agricultural land; 2) under fishponds and other bodies of water serving exclusively for agricultural purposes; 3) under residential buildings forming part of agricultural holdings and other buildings and equipment used exclusively for agricultural production and agri-food processing; 4) under buildings and equipment used directly for agricultural production recognized as a special department, in accordance with the provisions on personal income tax and corporate income tax; 5) rural parks and under trees and shrubs in the field, including also under windbreaks and anti-erosion devices; 6) family allotment gardens and botanical gardens;	Inclusivity	7) under the following devices: water, flood control and fire drainage, supply, sewage and sewage and waste disposal for agriculture and rural residents; 8) reclaimed for agricultural purposes; 9) peatlands and ponds; 10) under access roads to agricultural land ( <i>according to Act of 3 February 1995 on the protection of agricultural and forest land - Dz. U. [Journal of Laws] of 1995, No. 16, item 78</i> ).  An approach based on equality, acceptance of diversity, leading to social inclusion, ensuring equal opportunities for people from diverse backgrounds. The main objectives of inclusivity and diversity include: ensuring gender equality, eliminating all prejudice and discrimination, taking into account the needs of people with disabilities ( <i>according to Council of the European Union</i> ).	Public purpose investments	Activities of local (commune) and supra-local (district, voivodship and national), as well as national (also covering international and supra-regional investments), and metropolitan (covering the metropolitan area) importance, regardless of the status of the entity undertaking these activities and the sources of their financing, constituting the implementation of public objectives referred to in Article 6 of the Act of 21 August 1997 on real estate management ( <i>according to the Dz. U. [Journal of Laws] of 2021, item 1899</i> ).	Ecological corridor	An area enabling the migration of plants, animals or fungi ( <i>according to Act of 16 April 2004 on nature protection – Dz. U. [Journal of Laws] of 2004, No. 92, item 880</i> ).	Landscape	Space perceived by people, containing natural elements or products of civilization, shaped as a result of natural factors or human activity ( <i>according to Act of 27 March 2003 on spatial planning and development – Dz. U. [Journal of Laws] of 2003 No. 80, item 717</i> ).
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## Acronyms and definitions

### Definitions

Road map	A document containing proposed solutions (in the Green City and Climate Action Plan of Warsaw – in terms of moving towards climate neutrality).	Natura 2000 site	Special protection area for birds, a special area of conservation of habitats or an area of Community importance established for the purpose of protecting populations of wild birds or natural habitats or species of Community interest (according to <i>Law of 16 April 2004 on nature protection – Dz. U. [Journal of Laws] of 2004, No. 92, item 880</i> ).	Renewable energy sources	Renewable, non-fossil energy sources including wind energy, solar energy, aerothermal energy, geothermal energy, hydrothermal energy, hydropower, wave, current and tidal energy, energy obtained from biomass, biogas, agricultural biogas and bioliquids (according to <i>Renewable Energy Sources Act of 20 February 2015</i> )
Active mobility	Individual mobility carried out on foot or by bicycle, but also with the help of other non-motorised means of transport or ways of moving in space (on rollerblades, scooters).	Area of public space	An area of particular importance for satisfying the needs of residents, improving their quality of life and conducive to establishing social contacts due to its location and functional and spatial features, defined in the study of conditions and directions of spatial development of the commune (according to <i>Act of 27 March 2003 on spatial planning and development - Dz. U. [Journal of Laws] of 2003, No. 80, item 717</i> ).	Refuge	A place with conditions conducive to the existence of plants, animals or fungi threatened with extinction or rare species (according to <i>Act of 16 April 2004 on nature protection - Dz. U. [Journal of Laws] of 2004, No. 92, item 880</i> ).
Model Pathways	Model of emission paths and achieving climate neutrality			Public-private partnership	Joint implementation of the project based on the division of tasks and risks between a public entity and a private partner (according to <i>Act of 19 December 2008 on public-private partnership – Dz. U. [Journal of Laws] of 2009, No. 19 item 100</i> ).
Climate neutrality	A term that describes the equilibrium (zero balance) between greenhouse gases emitted and their storage or uptake from the atmosphere.				

## Acronyms and definitions

### Definitions

Paris Agreement	Adopted at COP21 in 2015, the Paris Agreement is the second binding document implementing the demands of the Framework Convention on Climate Change after the Kyoto Protocol signed in 1997. The aim of the Agreement is to limit the average increase in the Earth's temperature well below 2 degrees Celsius over the period 1750-2100, and to aim to limit this increase to 1.5 degrees Celsius. The Covenant also seeks to achieve carbon neutrality by 2050. To achieve this, the Covenant stipulates that all countries will announce voluntary targets for reducing greenhouse gas emissions from 2020 onwards. These targets will be revised and increased every five years.	Biologically Active Zone	Soil covered with vegetation and surface water on the building plot, and 50% of the sum of the surfaces of terraces and flat roofs, arranged as permanent lawns or flowerbeds on a substrate ensuring their natural vegetation, with an area of not less than 10 m <sup>2</sup> .	Land reclamation	Granting or restoring degraded or devastated land to utility or natural values through proper terrain, improvement of physical and chemical properties, regulation of water relations, restoration of soils, strengthening of slopes and reconstruction or construction of necessary roads (according to <i>Act of 3 February 1995 on the protection of agricultural and forest land – Dz. U. [Journal of Laws] of 1995, No. 16, item 78</i> ).
		Prosumer	At the same time, the producer and conscious consumer of products and services. The prosumer system consists in the possibility of producing energy from renewable sources for own needs and settling in a system of favorable discounts with energy companies.	Remediation	Subjecting soil, land and groundwater to measures which remove and reduce the amount of risk-causing substances; controls them and limits their spread so that the contaminated site ceases to pose a risk to human health or the state of the environment; and takes into account the current and, where possible, future use of the site. Remediation may consist in self-cleaning if it brings the greatest benefits to the environment (according to <i>Act of 27 April 2001, Environmental Protection Law – Dz. U. [Journal of Laws] of 2001, No. 62, item 627</i> ).
		Public transport	Publicly available regular passenger transport performed at specified intervals and along a specified transport line, transport lines or transport network (according to <i>Act of 16 December 2010 on public collective transport – Dz. U. [Journal of Laws] of 2011, No. 5, item 13</i> ).		

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## Acronyms and definitions

### Definitions

Nature-Based Solutions	cost-effective (economically efficient) solutions that simultaneously provide environmental, economic and social benefits and support climate change adaptation. These solutions introduce elements and processes found in nature and in the untransformed landscape into human-developed areas, through systemic, locally adapted and resource-efficient (according to <i>European Commission</i> ).	„Stop Smog”	A programme aimed at co-financing the implementation of projects involving the replacement or decommissioning of high carbon emission heat sources with low carbon emission heat sources, thermo-modernisation of single-family residential buildings, connection to a district heating or gas network.	Environment	All natural elements, including those transformed as a result of human activity, in particular the surface of the earth, minerals, water, air, landscape, climate and other elements of biodiversity, as well as the interaction between these elements (according to <i>Act of 27 April 2001 Environmental Protection Law – Dz. U. [Journal of Laws] of 2001, No. 62, item 627</i> ).
Biodiversity	Diversity of living organisms occurring in ecosystems, within species and between species, and diversity of ecosystems (according to <i>Act of 16 April 2004 on nature protection - Dz. U. [Journal of Laws] of 2004, No. 92, item 880</i> ).	Clean Transport Zones	An area where only vehicles that meet certain emission standards may drive to enable a reduction in air pollution. Petrol and diesel vehicles may be allowed to drive in the zone, provided they meet the criterion of a sufficiently high EURO emission standard and low car age - as part of the establishment of the zone, guidelines will be prepared for EURO standards and car age. The CTZ will be a selected area in the city, suitably marked. The area of the zone depends on the decisions of the Warsaw City Council and its designation is a requirement of the Air Protection Programme.	Green areas	Areas decorated with technical infrastructure and buildings functionally related to them, covered with vegetation, performing public functions, in particular parks, green areas, promenades, boulevards, botanical gardens, zoological gardens, historic gardens, cemeteries, greenery accompanying roads in the built-up area, squares, historic fortifications, buildings, landfills, airports, railway stations and industrial facilities (according to <i>Act of 16 April 2004 on nature protection - Dz. U. [Journal of Laws] of 2004, No. 92, item 880</i> ).
Water retention	Storage of rainwater on the ground surface, in the ground and in natural and artificial reservoirs.				

## Acronyms and definitions

### Definitions

Rail transport	Carriage of passengers by a means of transport running on rails or railway tracks, including trams or subways (according to <i>Law of 16 December 2010 on public collective transport – Dz. U. [Journal of Laws] of 2011, No. 5, item 13</i> ).	Warsaw Green Building Standard	A set of guidelines and recommendations for new and retrofitted municipal buildings (including a standard for educational facilities), leading to the achievement of the climate objectives set by the City of Warsaw in the building sector.	Reference range cont.	the International Energy Agency (IEA), the Chartered Institution of Building Services Engineers (CIBSE), the National Renewable Energy Laboratory (NREL).
Act 10H	Common name for the Law of 20 May 2016 on wind power investments.	Cross-sectoral cooperation	A voluntary relationship between different parties in which they join forces to achieve a common goal.	Green electricity	Electricity that is generated from renewable energy sources or nuclear energy.
Warsaw Climate Panel	A process of democratic decision-making by a randomly selected group of residents of the City of Warsaw, the aim of which was to enable the residents of the City of Warsaw to take part in the decision-making process concerning increasing the energy efficiency of the City of Warsaw and the share of renewable energy sources in the city's energy balance, as well as to identify the best possible solutions from the perspective of the common good.	Reference range	Benchmarks defined by the European Bank for Reconstruction and Development, developed on the basis of published international norms and standards, defined by global organizations such as the World Health Organization (WHO), the European Environment Agency (EEA), the Organization for Economic Co-operation and Development (OECD), Local Governments for Sustainability (ICLEI), the Inter-American Development Bank (IADB),	Sustainable development	Socio-economic development, in which a process of integrating political, economic and social activities takes place, with preservation of natural balance and sustainability of basic natural processes, in order to guarantee the possibility of satisfying the basic needs of particular communities or citizens both of the present generation and of future generations (according to <i>Act of 27 April 2001 Environmental Protection Law – Dz. U. [Journal of Laws] of 2001, No. 62, item 627</i> ).

## Acronyms and definitions

### Definitions (Appendix A – Tables of actions)

Timescale	Range of years in which the action will be implemented.	Pre-investment costs	Expenditure relating to pre-investment work, e.g., the preparation of an investment feasibility study, a study of the development of a legal framework, a technical or locational analysis, a plan or directions for development, a multi-variant concept.	Action benefits	Benefits related to improving the quality of environment and life in the city and strengthening the city's climate resilience.
Type of action	Specification of the type/scope of action, broken down into: capital programmes, operational activities, regulation, inclusive and supportive activities (see page 21 for descriptions of types of action).	Capital expenditure (CAPEX)	Expenditure related to the cost of constructing the facility, purchasing equipment, making the investment.	Enabling actions within the Green City and Climate Action Plan of Warsaw	Link between individual solutions implemented as part of the Green City and Climate Action Plan of Warsaw.
		Operating costs (OPEX)	Expenses associated with maintaining a product, business or system.	Enabling policies and actions	Links between the actions proposed in Green City and Climate Action Plan for Warsaw with existing and valid policies and activities in the city that aim to promote sustainable urban development and support urban resilience.
		Financing mechanisms	The way in which a company, organisation or programme receives the funding it needs to continue operating.		

## Acronyms and definitions

### Definitions (Appendix A – Tables of actions)

Action owner	The unit responsible for the preparation, implementation and monitoring of actions under the Green City and Climate Action Plan of Warsaw.
Bodies supporting the implementation of action	Units, organisations or individuals who participate in the creation of the project (take an active part in its implementation).
Stakeholders	Organisations or individuals with a direct interest in consulting on the implementation of the action and the results of its implementation.



The organisational structure of the basic units of the Office of the Capital City of Warsaw (Offices) is up-to-date as of 01.08.2022 and reflects the summary presented in the Public Information Bulletin of the Capital City of Warsaw.

Product indicator	The products, tools and solutions that will be implemented and created under the action.
Result indicator	Measurable impact resulting from the implementation of the action.
Smart potential	Opportunities to implement digital technologies, oriented towards smart, innovative solutions in the implementation of the action.
Gender and economic inclusion potential	Opportunities to implement solutions to increase inclusivity, social diversity and accessibility in the implementation of the action.

# Executive summary





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## Executive summary

### Introduction

Green City and Climate Action Plan of Warsaw supports the city in becoming a **climate-neutral, inclusive and socially diverse, ecological and climate-resilient city**. This document aims to support and inspire citizens, city authorities, institutions and non-governmental organisations by pointing out different types and areas of action with the overarching objective of becoming a sustainable, low-carbon city.

Crucial to the development of the GCCAP was the identification and agreement of the priority challenges for the city. Based on the analysis, these are:

the occurrence of urban heat island (UHI) and drought phenomena,

- loss of areas valuable for urban biodiversity,
- air pollution in the city,
- greenhouse gas emissions (GHG),
- pressure from municipal waste generation,
- the need to develop sustainable methods of municipal waste treatment and disposal,
- localised flooding (e.g. streets or building cellars flooded after a downpour) and flooding (Vistula River overflowing) caused by extreme rainfall.

### Methodology

The adopted approach uniquely combines the Green City Action Plan (GCAP) methodology developed by the European Bank for Reconstruction and Development (EBRD) with the Climate Action Plan (CAP) methodology adopted by the C40 Cities Climate Leadership Group for its member cities. The combination of the two methodologies made it possible to develop specific climate action scenarios and supporting solutions that will allow the City of Warsaw to achieve its goal of climate neutrality by 2050. The combined approach gives high priority to an open and inclusive process in the preparation of the document.

GCCAP was based on data and information obtained during many of meetings, consultations, workshops with city representatives, as well as from external stakeholders (i.e., individuals or businesses interested in the topic and willing to participate in the process). The measures implemented and plans already developed by the city, for example within the framework of the Warsaw Climate Panel, were also taken into account. The result is a roadmap with actions for a green city and climate (GCCAP). The document takes into account the long-term perspective of the Climate Action Plan, aiming to achieve climate neutrality by 2050 at the latest,

and sets out the short-term actions of the Green City Action Plan. In order to take into account the assumptions of actions for the benefit of the green city and the climate at the same time, the pursuit of climate neutrality was considered to be a particularly important factor influencing the choice of actions.

The climate action scenario adopted by the city in a 30-year timeframe (chosen from three options during the development of the document) is based on an assessment of current greenhouse gas emissions and the identification of possible measures to reduce them in order to achieve the climate goals set out in the Paris Agreement.

The Green City and Climate Action Plan of Warsaw was developed on the basis of technical and financial data available up to the end of 2021.

### City ambition

**Warsaw aims to reach net-zero emissions by the year 2050.** The city has set itself the important goal of reducing CO<sub>2</sub> emissions by 40% by 2030 compared to 2007 figures and is striving to go even further, aiming for further CO<sub>2</sub> reductions so as to keep Warsaw's level of greenhouse gas emissions within the limits set by the Paris Agreement. The transition represents real social and economic benefits for residents.

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## Executive summary

### City ambition cont.

In order to support the reduction of greenhouse gases in the city, the GCCAP proposes the development of 27 activities in five sectors, covering:

1. energy infrastructure,
2. buildings,
3. urban planning and blue-green infrastructure,
4. transport,
5. solid waste.

A cross-sector group of actions (including capital building and integration) proposed for implementation in the short term has also been identified.

It is estimated that the total capital cost (sum of pre-investment costs and CAPEX) of the activities will be over 4.3 billion EUR. Whereas the total implementation of the proposed measures will incur annual costs (OPEX) of over 139 million EUR. However, it should be borne in mind that the list of actions is only a set of proposals that the city can follow in order to accelerate the achievement of the selected climate action scenario in a 30-year perspective.

Short-term actions include both capital investment and supportive actions. Capital investments implemented over a 5-10 years will be part of the **GCCAP Reduction Scenario** and will contribute to an estimated reduction of **carbon dioxide emissions by one million tonnes** per year when fully implemented.

As a result of the implementation of actions in all the indicated sectors, which are included in the Green City Action and Climate Plan of Warsaw, the quality of life for residents will be significantly improved. In addition, the implementation of these actions will lead to a number of additional environmental benefits, such as improving the condition of green areas throughout the city, ensuring the protection and development of blue-green infrastructure and its integration into urban spaces.

### Current circumstances, local challenges and wider context

For a long time now, Polish local authorities have been struggling with financial stresses that are seriously affecting their budgets. In addition, the coronavirus pandemic has had a huge impact on the economy, straining already severely damaged public finances. An additional factor impacting on local government budgets is the situation related to the Russian invasion of Ukraine, which has triggered a process of avalanche migration of refugees into Poland, most especially in Warsaw.

**The increasing demands on local authorities, the continuous expansion of their competences and the increase in their responsibilities have a significant impact on their financial situation.** Budgets are saddled with more and more expenses every year.

Despite the appropriate and efficient redistribution of financial resources, budgets are becoming increasingly tight, with the result that financial deficits can be created, which exacerbates the overall public debt. Decision-makers are doing their utmost to make the planned budget as rational as possible and - at the same time - to be able to meet all the challenges.

It should also be kept in mind that the law provides for local government debt limitation, which involves a case-by-case approach to calculating the allowable level of local government debt. This is determined by the unit relation of the amount of debt service to the funds that can legally be used to repay it, and by the fact that local authorities are required to balance the budget in the operational (current) part. Meeting these requirements is the next challenge for local authorities.

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## Executive summary

### Current circumstances, local challenges and wider context cont.

**The objective to be pursued by all local and regional authorities is not only to fulfil their responsibilities and the development directions they have set, but above all to improve the living conditions and safety of their inhabitants and to encourage their development by creating appropriate and favourable conditions.** The implementation of the GCCAP assumptions has the potential to significantly impact on aspects of life related to health, wellbeing, prosperity and better living conditions.

It is worth bearing in mind that the Green City and Climate Action Plan of Warsaw is not a strategic document, however, it is an important document due to the actions and scenarios set out, which can help transform the city into a more environmentally and inhabitant-friendly place. **The estimates of costs presented in the document are intended to show the scale of the economic challenge facing the city.** It should also be kept in mind that it is not only local government entities that will bear the financial consequences. The proposed actions and investments illustrate the extent of the city's problems and needs. They also make individual entities aware of the amount of financial outlays needed to generate as quickly as possible in order to prevent or adapt to climate change.

### This road map is designed to help the city find alternative and potential sources of funding to implement the activities identified here.

The stated objectives and stipulations will help to identify and find new funding prospects, while assisting the local government budget in obtaining investment funding from other external sources such as:

- financing from national resources, e.g., from the National Fund for Environmental Protection and Water Management or the Provincial Fund for Environmental Protection and Water Management,
- International Financial Institutions (e.g., EBRD, EIB),
- EU grants (NextGenerationEU, e.g., under the Recovery and Resilience Facility Fund and the European Green Deal),
- Public-private partnerships,
- ESCO formula,
- In a few cases, financial benefits can also be obtained from a betterment levy, planning rent or regulations under Article 16 of the Public Roads Act.

The solutions presented here will also be a strong asset and advantage for the local government in obtaining financial support from currently planned

and future funding mechanisms related to the implementation of EU regulations and requirements resulting from the Community's pursuit of climate neutrality.

A detailed financial analysis was carried out for all activities. Pre-investment, capital and operating costs were estimated, based on standard market indicators and expert opinions. Numerous benchmarks of market bids, public tenders, results of specialised reports, studies and analyses carried out by the city were used to achieve that.

In the phase of finalizing the Warsaw Green City and Climate Action Plan, the city became a participant in the European Union's Climate-Neutral and Smart Cities mission. The aim of the mission is to achieve climate neutrality by 2030, which is a huge challenge for the city to intensify its efforts to implement innovative and bold solutions to achieve climate neutrality in all sectors, such as energy, buildings, solid waste and transport, together with related investment plans. It is expected that this GCCAP will form a solid foundation for the continued work on climate action.

## Executive summary

### Limitations

It should be recognised that the estimates of capital expenditures presented in this document do not represent the full financial outlay to deliver the proposed actions. The current geo-political situation, the energy crisis and the associated economic impact can cause significant fluctuations in prices and exchange rates in global markets. For some actions, only unit costs have been presented, due to the need for more in-depth research and analysis of the city's needs. Potential funding mechanisms have also been suggested for each action. The provisions contained in the individual actions have been systematically shared and consulted with all affected City Offices.

The Green City and Climate Action Plan of Warsaw was prepared on the basis of up-to-date data obtained during its development and internal expert analyses. It is also worth noting that the plan was well advanced before Warsaw began to experience the influx of war refugees from Ukraine. The plan could therefore not fully take into account the consequences of this massive and unpredictable migration, which in reality is very dynamic in nature and involves great uncertainty about the course and stability in the coming months.

The assessment of the impact of mass migration on the city's infrastructure can be a separate study.

At the same time, the Warsaw Green City and Climate Action Plan provides a valuable framework for supporting the sustainable development of the city in the long term. This document will form the basis for the implementation of the investment, helping the city to respond to the needs of refugees in accordance with the long-term objectives of the city and its short-term needs.

### Action summary

The pages overleaf provide a summary of the proposed short-term actions covering the period to 2030, which will be an inspiration in the context of the directions of the city's development and future implementations.



Photo: Victor Malyshev, Unsplash







## Executive summary

Types of short-term actions in the 2030 perspective proposed in the Green City and Climate Action Plan of Warsaw

Action type	Definition	Short term actions
Capital programs	Long-term, comprehensive and multivariate, capital-intensive investment projects that requires planning and resources.	<u>E2</u> , <u>E3</u> , <u>E8</u> , <u>B2</u> , <u>B3</u> , <u>R1</u> , <u>R2</u> , <u>R3</u> , <u>R4</u> , <u>T1</u> , <u>T2</u> , <u>T3</u> , <u>T4</u> , <u>T6</u> , <u>IT1</u> , <u>IT2</u> , <u>Ok1</u> , <u>Ok2</u>
Enabling actions	Initiatives, programs, municipal interdisciplinary teams, the introduction of which will enable and facilitate the implementation of specific actions selected for the implementation of the Green City and Climate Action Plan of Warsaw and will create conditions for further and constant development of green actions in the future.	<u>E5</u> , <u>E6</u> , <u>E7</u> , <u>T5</u>
Operational actions	Intra-city solutions allowing for the implementation of coherent actions by municipal units.	<u>E1</u>
Policy actions	Standards and policies that create the potential for resource efficiency and management.	<u>B1</u>
Inclusive actions	Actions raising public awareness, increasing the city resilience and supporting residents and counteracting social exclusion.	<u>E4</u> , <u>PS1</u> , <u>PS2</u>



## Executive summary

Short-term actions in the 2030 perspective in Energy Infrastructure

ID	Action	Action type	Pre-investment (EUR)*	CAPEX (EUR)*	OPEX (EUR/yr)*	Action owner	Timeline									
							2023	2024	2025	2026	2027	2028	2029	2030		
E1	<u>Purchase of green energy for municipal units</u>	Operational action			34.525m	• Infrastructure Department										
E2	<u>Generation of green Energy by the city within and outside Warsaw's borders</u>	Capital program	591.5k	131.7m	1.842m	• Infrastructure Department										
E3	<u>Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral</u>	Capital program		14.7m	6.702m	• Municipal Water and Sewerage Company										
E4	<u>Development of a Municipal Hydrogen Program</u>	Inclusive action	186k			• Infrastructure Department										
E5	<u>Creation of the Municipal Energy Agency</u>	Enabling action	76.6k		328.5k	• Infrastructure Department										
E6	<u>Energy strategic partnership</u>	Enabling action	33k		6.6k	• Infrastructure Department										

## Executive summary

Short-term actions in the 2030 perspective in Energy Infrastructure – cont.

ID	Action	Action type	Pre-investment (EUR)*	CAPEX (EUR)*	OPEX (EUR/yr)*	Action owner	Timeline									
							2023	2024	2025	2026	2027	2028	2029	2030		
E7	<u>Creation of a Sustainable Energy Investments Fund</u>	Enabling action	76.6k	17.5m	65.7k	• Infrastructure Department										
E8	<u>Outdoor city lighting – LED retrofit</u>	Capital program		11m	3.3m	• Municipal Roads Authority										
<b>Total</b>			<b>963.7k</b>	<b>174.9m</b>	<b>46.769m</b>											

\* Price estimates were made on the basis of indicator prices from 2021

## Executive summary

Short-term actions in the 2030 perspective in Buildings





ID	Action	Action type	Pre-investment (EUR)*	CAPEX (EUR)*	OPEX (EUR/yr)*	Action owner	Timeline													
							2023	2024	2025	2026	2027	2028	2029	2030						
B1	<u>Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction</u>	Policy action	76.6k			• Air Protection and Climate Policy Department														
B2	<u>Program to improve the energy efficiency of municipal buildings with a pilot</u>	Capital program		1.124bn		• Air Protection and Climate Policy Department														
B3	<u>Continued replacement of high-emission heat sources</u>	Capital program		47.221m	157.7k	• Air Protection and Climate Policy Department														
<b>Total</b>			<b>76.6k</b>	<b>1.171bn</b>	<b>157.7k</b>															

\* Price estimates were made on the basis of indicator prices from 2021



## Executive summary

Short-term actions in the 2030 perspective in Urban planning and Blue-Green infrastructure

ID	Action	Action type	Pre-investment (EUR)*	CAPEX (EUR)*	OPEX (EUR/ryr) *	Action owner	Timeline									
							2023	2024	2025	2026	2027	2028	2029	2030		
R1	<u>Increasing biologically active surfaces and removing impermeable surfaces</u>	Capital program		61m+ 930/m <sup>2</sup> + 33k-55k+ 250/m <sup>2</sup> + 50/m <sup>2</sup> + 3.2k/m <sup>2</sup>	106.5k+ 1.6/m <sup>2</sup> + 50/ha	• Environmental Protection Department										
R2	<u>Protection and restoration of valuable green areas</u>	Capital program	405.6k	118m	121k + 300/ha	• Environmental Protection Department										
R3	<u>Preservation &amp; restoration of urban greenery Zakole Wawerskie</u>	Capital program		49.1m	1.35m	• Environmental Protection Department										
R4	<u>Greening streets</u>	Capital program	142k	35.5m + 480k/km	115k	• Municipal Roads Authority										
<b>Total</b>			<b>547.6k</b>	<b>263.655m</b>	<b>1.693m</b>											

\* Price estimates were made on the basis of indicator prices from 2021

\*\* For unit prices, in-depth research is needed to identify the specific needs of the city.





## Executive summary

Short-term actions in the 2030 perspective in Transport

ID	Action	Action type	Pre-investment (EUR)*	CAPEX (EUR)*	OPEX (EUR/yr)*	Action owner	Timeline									
							2023	2024	2025	2026	2027	2028	2029	2030		
T1	<u>Continued expansion of municipal integrated rail transport</u>	Capital program	1.677m	722.867m	47.8m	<ul style="list-style-type: none"> <li>Metro Warszawskie Sp. z o.o.</li> <li>Tramwaje Warszawskie Sp. z o.o. (track ownership)</li> </ul>										
T2	<u>Convenient and safe zero-emission public transport</u>	Capital program		969.1m	35.6m	<ul style="list-style-type: none"> <li>Infrastructure Department</li> </ul>										
T3	<u>Development of transport interchange and communication hubs</u>	Capital program	888k	40.3m		<ul style="list-style-type: none"> <li>Infrastructure Department</li> </ul>										
T4	<u>Support for the development of electromobility</u>	Capital program		11.2m	560k	<ul style="list-style-type: none"> <li>Municipal Roads Authority</li> </ul>										

## Executive summary



Short-term actions in the 2030 perspective in Transport – cont.

ID	Action	Action type	Pre-investment. (EUR)*	CAPEX (EUR)*	OPEX (EUR/yr)*	Action owner	Timeline									
							2023	2024	2025	2026	2027	2028	2029	2030		
T5	<u>Research on public transport needs</u>	Enabling action	76.6k			• Architecture & Spatial Planning Department										
T6	<u>Program supporting the implementation of Clean Transport Zones</u>	Capital program	76.6k			• Road Traffic Management Department										
IT1	<u>Integrated ticketing for the agglomeration as a part of public transport management</u>	Capital program		28.55m		• Public Transport Authority										
IT2	<u>Smart local energy systems including vehicle-to-grid and vehicle-to-building</u>	Capital program	186k			• Infrastructure Department										
<b>Total</b>			<b>2.905m</b>	<b>1.772bn</b>	<b>83.96m</b>											

\* Price estimates were made on the basis of indicator prices from 2021

## Executive summary

Short-term actions in the 2030 perspective in Solid waste

ID	Action	Action type	Pre-investment. (EUR)*	CAPEX (EUR)*	OPEX (EUR/yr)*	Action owner	Timeline							
							2023	2024	2025	2026	2027	2028	2029	2030
Ok1	<u>Municipal biogas plants development program</u>	Capital program	27.4k	48.173m	5.474k	Municipal Cleaning Company								
Ok2	<u>HWRC - Household waste recycling centres</u>	Capital program	328.5k	2.041m	1.2m	• Waste Management Department								
<b>Total</b>			<b>355.9k</b>	<b>50.214m</b>	<b>6.674m</b>									

\* Price estimates were made on the basis of indicator prices from 2021

## Executive summary

Short-term actions in the 2030 perspective in Equity and inclusion

ID	Action	Action type	Pre-investment. (EUR)*	CAPEX (EUR)*	OPEX (EUR/yr)*	Action owner	Timeline									
							2023	2024	2025	2026	2027	2028	2029	2030		
PS1	<u>Education campaigns</u>	Inclusive action	2.7m			• Centre for Public Communication										
PS2	<u>Tackling energy poverty</u>	Inclusive action		923.7m		• Air Protection and Climate Policy Department										
<b>Total</b>			<b>2.7m</b>	<b>923.7m</b>												

\* Price estimates were made on the basis of indicator prices from 2021

# 1. Introduction



# 1. Introduction

## 1.1 Context and assumptions of the Green City and Climate Action Plan of Warsaw

### Context

Warsaw's Green City and Climate Action Plan ('GCCAP' or 'the Plan') will be vital tool for the city's journey towards becoming a climate neutral, inclusive, green and resilient city. Based on a rigorous assessment of the city's environmental challenges and carbon emissions, the GCCAP identifies long-term greenhouse gas reduction strategies and a set of short-term actions that will allow to achieve environmental and climate objectives while meeting the city's needs. This Plan aligns with and builds on our existing plans, in particular the:

- Warsaw2030 strategy,
- Climate change adaptation strategy for the Capital City of Warsaw until 2030 with a perspective until 2050.

The GCCAP has been prepared with the technical assistance from the European Bank for Reconstruction and Development (EBRD) and funding support from Taiwan Business' EBRD Technical Cooperation Fund and of the Polish Ministry of Finance.

It brings together the Green City Action Planning methodology from the EBRD's Green Cities program, and the Climate Action Planning framework from the C40 Cities Climate Leadership Group.

The plan has been developed in line with international agreements, including the UN "The 2030 Agenda for Sustainable Development", the 2015 Paris Agreement, the Convention on Biological Diversity (UNCBD), the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE), as well as in compliance with the relevant policy at municipal, regional and national level at the time of the Plan's writing.

### Assumptions

The purpose of the GCCAP is to support in developing targeted plans and projects to tackle the challenges faced as a city. Reflecting our priorities and needs allows us to reach our 2050 climate neutrality goal whilst contributing to thriving and healthy lives for our city's residents. The GCCAP will support the process of finding sources of funding for the most important environmental projects in the city. By identifying policy and enabling measures the GCCAP will support these projects and improve the environmental quality of Warsaw, incl. thanks to the list of proposed supporting actions, policies or potential funds included in the document. It also includes a monitoring and evaluation framework that will enable actions to be tracked and communicated over time, as well as a plan to include a broad range of stakeholders within the plan's delivery.



Photo: City of Warsaw

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# 1. Introduction

## 1.1 Context and assumptions of the Green City and Climate Action Plan of Warsaw

### Limitations

The evidence base that was developed to inform this plan was prepared according to the EBRD methodology, and the emissions inventory was developed using the C40 CAP framework. Whilst overall the data acquired was robust and of good quality, in some areas data was unavailable or limited and therefore afforded a less precise picture of the environmental quality of the city and the potential impact of actions. The plan has been developed based on data received by the GCCAP project team within a limited time frame. The results of the collected and processed data were presented in the city's technical condition report and consulted with representatives of the City Hall department.

As part of the work, a set of short-term actions that could be implemented was prepared in the perspective of 5-10 years. For each of the measures, information on the potential costs of their implementation and the benefits of their implementation are presented. A detailed feasibility study will be required prior to the implementation of each actions.

### Structure of the GCCAP

The GCCAP has been structured into six sections and three appendices as below:

**Section 1: Introduction** sets out the Plan's and summarizes its assumptions.

**Section 2: GCCAP preparation approach** provides an overview of the methodology used to develop the GCCAP.

**Section 3: City baseline** summarises the environmental and policy evidence based development, as well as the city-wide carbon dioxide emissions inventory.

**Section 4. Green City and Climate Action Plan, scenarios and targets** presents a vision of how the city should proceed towards climate neutrality, **a GCCAP Reduction Scenario for Warsaw** based on inventory and emission modeling as well as short-term objectives to be achieved within 10-15 years.

**Section 5: Green City actions** present short-term actions of the GCCAP, divided by the following sectors: transport, buildings, energy infrastructure, water, green areas and biodiversity, municipal waste and one intersectoral group of actions.

**Section 6: Monitoring, Reporting and Verification (MRV)** sets out monitoring methods and communicating the effectiveness of GCCAP implementation, both in terms of actions taken and outcomes achieved.

**Appendix A:** Green City Action Description.

**Appendix B:** Policy review.

**Appendix C:** Emissions inventory and climate action scenarios over a 30-year perspective.

**Appendix D:** Public consultation.



# 1. Introduction

## 1.1 Context and assumptions of the Green City and Climate Action Plan of Warsaw

### General characteristics of the city

Warsaw is located in the central part of Poland, in the Masovian Plain. The city covers an area of 517 km<sup>2</sup>, and straddles the Vistula River, the largest of the Polish rivers. The most distinctive element of Warsaw's landscape is the Vistula valley protected by the European nature network Natura 2000. Warsaw is located in the temperate – transitional climate zone. During the year, continental and ocean air masses flow over the city, which results in a large variation in weather conditions in the area of Warsaw. There are cold winters, which exacerbate the need for intensified heating of buildings, whereas warm summers are associated with heat waves and periods of drought. There is also an urban heat island phenomenon in the city, with noticeably higher temperatures and lower rainfall in the city center compared to the periphery.

Warsaw is the centre of a metropolitan area whose population is estimated at approximately 3 million inhabitants, 1.86 million of which live within the city's administrative borders (2021).<sup>1</sup> and this number is growing every year. Data before the COVID-19 pandemic shows that around 300 000 people commuted daily into the city of Warsaw (from and to their place of residence) from the suburban zone<sup>2</sup>.

Warsaw is the largest economic centre in Poland and one of the most important centres of economic activity in the region of Central and Eastern Europe. Following the Second World War, the city developed into an industrial and service centre, and the expansion of heavy and electromechanical industries were prioritised. During the 1990s, the economic structure of the city shifted towards the services sector, including educational services, the research and technology development sector. During this period, most of the city's industrial production disappeared, leaving only the most efficient and technologically advanced facilities within the city borders.

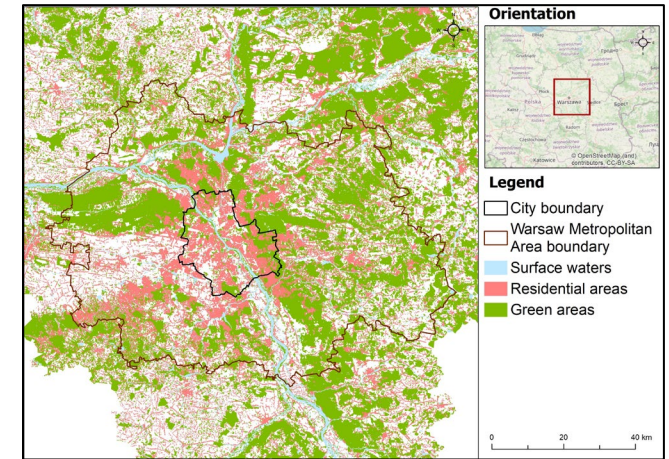


Figure 1. Warsaw City boundaries

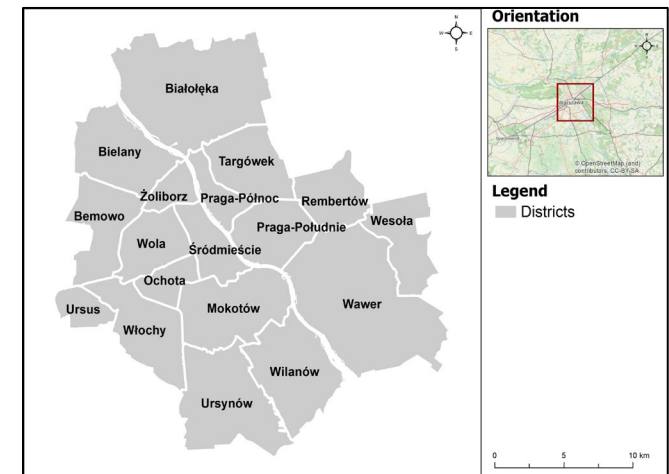


Figure 2. Warsaw district boundaries

## 2. GCCAP preparation approach



## 2. GCCAP preparation approach

### 2.1 Process of preparing the Green City and Climate Action Plan of Warsaw

The GCCAP preparation process was broken down into four key steps.

- **Step 1 City baseline:** analysis of the current situation in terms of existing and implemented policies, the state of the environment and greenhouse gas emissions.
- **Step 2 Action development:** identifying, selecting and developing of the Green City and Climate Actions.
- **Step 3 Action implementation:** determining the timeline, resource and capacity needs for the delivery of the GCCAP.
- **Step 4 Monitoring and reporting:** establishing a framework for tracking implementation progress over time.

Achieving the city's environmental and climate objectives will require urgent, ambitious action, relying on robust data to inform targeted actions.

To be successful, the Plan must embody the needs and perspectives of the communities needs. It must also be consistent with the priorities included in the documents programming the development of the City of Warsaw. Therefore, the adopted approach has been constructed around the following three success factors:

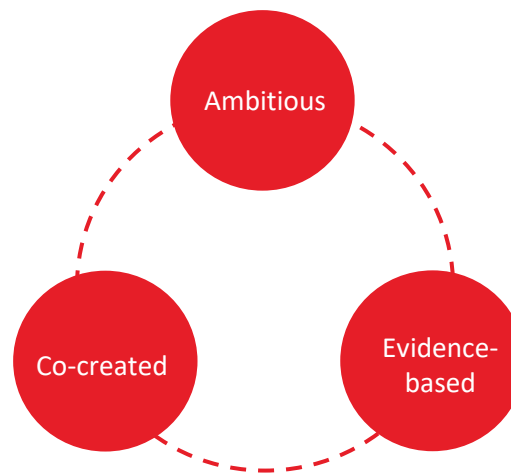


Figure 03. Success factors of the Warsaw GCCAP

#### Evidence-based

The basis of this document is a thorough analysis of the existing state of the city, which was preceded by a process of detailed data collection:

- 1) policy and socio-economic baseline,
- 2) collection of data to create a database of more than 120 environmental indicators,
- 3) greenhouse gas emissions inventory.

Further details on each can be found in Section 3.

#### Co-created and inclusive

Engagement has been a fundamental part of the GCCAP process. Stakeholders were engaged in key stages of the process:

- first meetings related to the identification of challenges faced by the city,
- workshops identifying priority challenges for city,
- talks about objectives that should be included in the GCCAP,
- during work on the definition and development of act.

#### Ambitious

In this GCCAP, we set truly ambitious targets for our city to achieve climate neutrality. The actions included have been selected to take practical, meaningful steps towards achieving these objectives, identifying projects and policies that are both feasible, as well as impactful and creating plans for their implementation.

## 2. GCCAP preparation approach

### 2.1 Process of preparing the Green City and Climate Action Plan of Warsaw

#### City baseline

The baseline stage included significant data collection for the database along with the analysis in order to compare them with the quantitative and qualitative indicators from the EBRD methodology regarding the state of the environment and the functioning of major urban sectors. The database was one of the elements of the city condition analysis. Additional materials and information were also collected to best recognize the context of the city's environment, the form and condition of the main components of the city's system, including water, energy and waste infrastructure, transport systems, buildings and green areas.

A wide range of stakeholder groups were involved in the plan's development to ensure that the chosen actions reflected the diverse breadth of voices across the city. Stakeholders from city departments, NGOs, academia, community organizations and businesses participated in the process through workshops, meetings, surveys and written feedback.



Photo: City of Warsaw

## 2. GCCAP preparation approach

### 2.1 Process of preparing the Green City and Climate Action Plan of Warsaw

#### Indicator database

As part of the city baseline, a database of 120 indicators was developed in order to gain an overall picture of the current state of Warsaw's environment, guided by the EBRD Green Cities program Methodology. This process allows for a rapid, evidence-based assessment of the key environmental challenges within Warsaw and together with wider stakeholder engagement was used to inform the priority action areas for the GCCAP. The indicators can be broken down into three categories:

- 1) 'Pressure' indicators describe the urban systems that drive changes in the environment,
- 2) 'State' indicators provide the current condition of the environment,
- 3) 'Response' indicators identify the extent to which existing action is being taken to address environmental changes through policy, investment and behaviour.

Information was obtained from multiple sources, including government departments, utility and public service companies, published data and reports, and direct communication with relevant authorities. The data collection process was supported by a data quality assessment. In some cases, expert judgement was used to fill in data gaps to achieve a comprehensive understanding of Warsaw's and

surrounding environment. Each indicator was compared against a traffic light system of benchmarks based on the EBRD Green Cities program Methodology, in order to indicate its relative performance and where data was available for multiple years, trends were established to identify whether the value was worsening, improving, fluctuating or stable.

#### Prioritisation

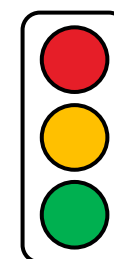
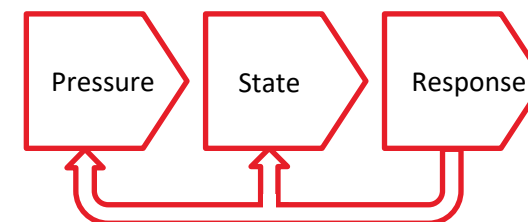
The results of the database analysis, along with a wider analysis of the city's state, political framework and socio-economic state, and an inventory of greenhouse gas emissions, were needed to prepare the basis for the identification of key priority challenges. The key stage in identifying the priority challenges was the involvement of stakeholders and joint discussion of the results of the analyses, and then agreeing on the key environmental and climate challenges.

#### Vision and objectives

We developed through consultation with stakeholders a Green City Vision. As the GCCAP combines two C40 and EBRD methodologies with different time scopes, two groups of broad objectives were identified during the workshops with stakeholders.

The first group of objectives were the long-term climate objectives to be achieved by 2050. The second group consists of short-term objectives to be achieved in the next 10-15 years. These objectives are compatible, and their determination made it possible to select short-term actions.

The long-term objectives are based on the 30-year climate action scenarios that include modeling reduction scenarios for 2030 and 2050. Implementing the actions identified in the GCCAP will bring the city closer to both the objective of reducing greenhouse gas emissions by 40% by 2030 and the objective of achieving climate neutrality by 2050. An extended scenario has also been developed in the Annex B.



Indicator value is worse than the red benchmark.

Indicator value is within the acceptable range.

Indicator value is better than the green benchmark

Figure 4. Categories of indicators for assessing the state of the current city

## 2. GCCAP preparation approach

### 2.1 Process of preparing the Green City and Climate Action Plan of Warsaw

#### Long-term thinking, immediate action

Our method draws on a hybrid top-down – the decision is taken by the city authorities and bottom-up – the decision is in the hands of residents and stakeholders. Moreover, as mentioned earlier, the Warsaw GCCAP is developed on the basis of two combined methodologies.

- The **C40 Cities CAP Framework**, which focuses on high ambition climate action. Based on the analysis of data and scientific material, scenarios for climate-neutral action are developed. It is planned to update the city's GHG inventory in 2-years cycle. The update of the mitigation components of the plan will be made every 5 years. There is a need for regular update of the adaptation and resilience component of the CAP.
- The **EBRD GCAP Methodology** develops an in-depth understanding of the city's current environmental challenges and prepares short term actions to address them in line with the city's longer-term visions and objectives.

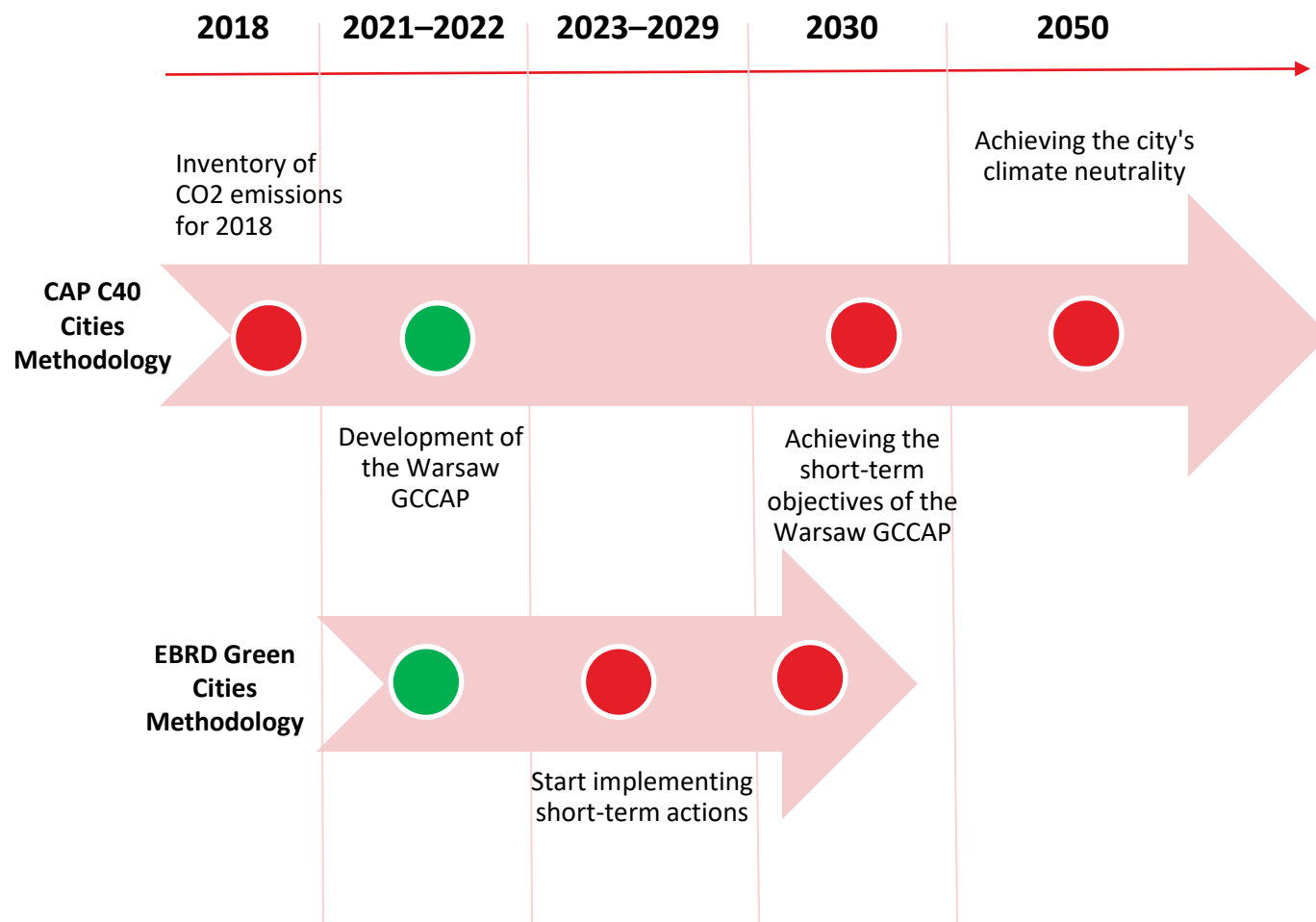


Figure 5. The process of preparing and implementing the Warsaw Green City and Climate Action Plan

## 2. GCCAP preparation approach

### 2.1 Process of preparing the Green City and Climate Action Plan of Warsaw

#### Long-term thinking, immediate action cont.

As a result, **the combined GCCAP** approach enables the city to identify the path to zero emissions by 2050, with a specific set of proposed actions that can be implemented in the short term, starting the path to zero emissions, inspiring and catalysing the achievement of long-term objectives.

This is the first integrated plan ever prepared in cooperation the EBRD Green Cities program. Lessons learned from the process will be used both to support future plan reviews and will be shared to enable similarly ambitious and progressive plan making by other cities.

#### Environmental protection within the actions of the GCCAP

The GCCAP document helps to solve environmental problems in Warsaw, including air pollution, urbanisation pressure on environmentally valuable areas, carbon-intensive urban transport, inefficient waste management and low environmental awareness among residents. For the planned projects that may potentially significantly or significantly affect the environment in accordance to the Regulation of the Council of Ministers of 10th September 2019 on projects that may significantly affect the environment - in each case, a procedure for obtaining a decision on environmental conditions will be conducted. As part of this procedure, the impact of the investment on all components of the natural environment, including forms of nature conservation and locally inventoried protected species, will be comprehensively examined each time. In addition, the guidelines for the implementation of tasks under the tenders will be based on the suggestions from action B1 *Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction* and on the existing rules for the realisation of environmental investments in the implementation of these tasks.



Photo: Zuzanna Korcz, Unsplash

## 2. GCCAP preparation approach

### 2.2 Selection of short-term actions within the Green City and Climate Action Plan of Warsaw

#### Action identification and selection

Actions were selected through a rigorous, iterative and inclusive process and evaluated to indicate their environmental, social and financial implications.

#### Actions longlist

A longlist of 130 actions was developed to respond to the priority challenges identified across key sectors:

- Energy Infrastructure,
- Buildings,
- Green Space and Biodiversity,
- Transport,
- Solid Waste,
- Water.

Descriptions of each potential action were prepared, including consideration of the local context, key benefits, risks and challenges, delivery stakeholders, funding implications and the extent to, which the city holds the power to implement the action directly.

The longlist drew on existing city actions (ongoing and planned) as well as new potential actions identified by the project team and wider stakeholders.

#### Multicriteria shortlist

Actions from the long list were assessed for their potential to address environmental issues, and to ensure inclusivity and social diversity. There were 2 main categories with sub-categories for actions ranking. First category was Environmental priorities scoring included sub-categories: Reduction in energy demand, Increase in renewables / reduction in fossil fuels, Reduction in car use, Increase in active travel / public transport, More and/or better green space, Increase in climate resilience, Improvement in wastewater and rainwater network, Improvement in local waste treatment. Second category was Potential for Gender & Social Inclusion scoring including sub-categories: Economic inclusion, Gender equality, Community involvement. The actions with the lowest ratings were excluded from the long list, and those with the highest – were developed and described in more detail and formed a short list of actions, which was scrutinised in stakeholder workshops, meetings with city offices and consultations with the EBRD and C40.

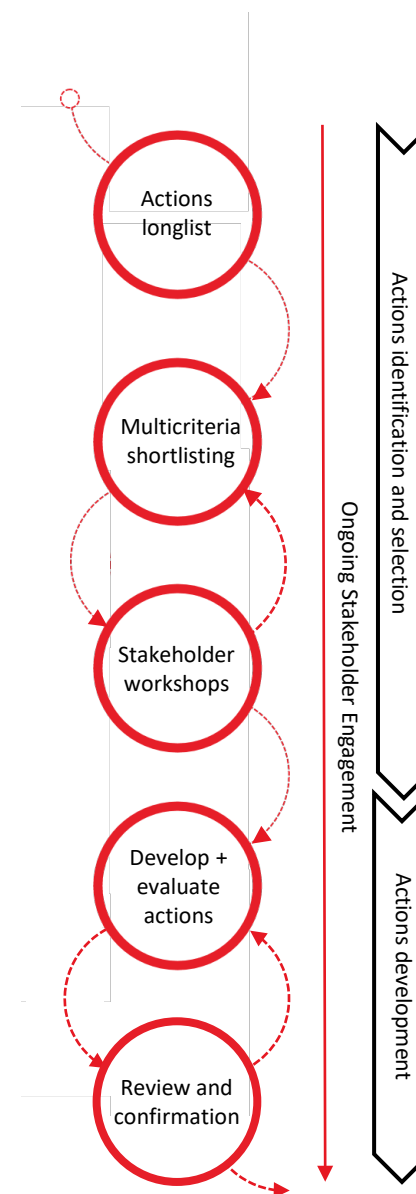


Figure 6. Stages of developing the actions of the Warsaw Green City and Climate Action Plan



## 2. GCCAP preparation approach

### 2.2 Selection of short-term actions within the Green City and Climate Action Plan of Warsaw

#### Selected actions

As the result of described process the 27 GCCAP actions were selected to respond to the challenges identified at an earlier stage and to support the city on the path to achieving the 2030 reduction objectives and climate neutrality by 2050.

The actions can be implemented over the next few years. They are also in line with the long-term objectives of the **GCCAP Reduction Scenario**.

The types of information provided in the actions included in the GCCAP are shown below:

- **Type of action** - from actions involving direct investment in the built environment to actions supporting policies, laws and regulations.
- **Capacity building** - tools, knowledge and skills to enable the City of Warsaw and other stakeholders to implement actions.
- **Public information campaigns** - building awareness and collaboration to deliver local improvements.
- **Monitoring and data collection** - smart use of data to enable evidence-based decision-making and progress monitoring.

Types of actions included in the GCCAP are presented on [page 21](#).



Photo: Maksym Harbar, Unsplash

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## 2. GCCAP preparation approach

### 2.2 Selection of short-term actions within the Green City and Climate Action Plan of Warsaw

#### Action list review

The scored actions list was then tested and refined by city and external stakeholders during sectoral workshops and subsequent review processes, in order to establish a list of actions that represented an appropriate ambition level and sectoral balance.

#### Alignment of actions with short- and long-term objectives

The proposed actions under the Green City and Climate Action Plan were linked to the the selected and developed **GCCAP Reduction Scenario**. It takes into account the required sectoral levels of greenhouse gas emission reduction in Warsaw to be achieved in a 30-year perspective.

#### Action development

The shortlist of actions was developed, quantified and evaluated according to the following parameters:

1. Action description, assumed or estimated scale of the action, city context and jurisdiction considerations.
2. Implementation timeline, type of action.

3. Action owner, bodies supporting the implementation of action, stakeholders.
4. High-level financial assessment subdivided into estimated pre-investment (preparation/feasibility), capital and operational expenditure requirements and potential financing mechanisms.
5. Quantitative benefits assessment comprising cost and carbon emissions savings where possible.
6. Additional qualitative environmental and socioeconomic benefits.
7. Enabling policies and actions within the GCCAP.
8. Performance monitoring metrics in terms of outputs and outcomes.
9. Technological potential and integration with smart systems.
10. Integration of gender and inclusion considerations in action development and implementation.

#### Financial assessment

For all actions, a detailed financial analysis was carried out to estimate pre-investment, capital and operating costs, based on standard market indicators and expert judgement.

To establish the estimated costs for the implementation of the indicated actions, a benchmark of market bids, public procurement and the results of specialised reports from research institutions in 2021 were used. Numerous studies and analyses provided by the city were also used to identify the city's needs and calculate costs.

It should be noted that the cost estimates presented in this document do not represent the full financial expenditure. In the case of some actions, only unit costs are presented, e.g., per m<sup>2</sup> or per hectare. The presentation of full investment expenditure estimates will be possible after carrying out detailed analyses and studies included in the actions that allow the specific and individualised needs of the city to be determined.

The arithmetic average exchange rate of the EUR in 2021 has been assumed in this analysis at 4.567 PLN (Ministry of Finance). It should be highlighted that due to geopolitical circumstances, the euro exchange rate is subject to upward trends, which may affect the cost of actions estimated in the document.

## 2. GCCAP preparation approach

### 2.2 Selection of short-term actions within the Green City and Climate Action Plan of Warsaw

#### Financial assessment cont.

The provisions contained in the individual actions were systematically shared and consulted with all City Offices. Potential financing mechanisms were also suggested for each action, based on recent projects in Warsaw, including: city and state budgets, EU financial support programs, and private sector engagement. Of these financing mechanisms, EU-based public investment funds have been identified as having strong potential.

#### Benefits assessment

The actions presented in the GCCAP have the potential to deliver a range of environmental, social and economic benefits within Warsaw. The benefits of the actions extend well beyond economic development and include several positive aspects for the urban natural environment and for the quality of life for residents, prosperity and economic growth within the City of Warsaw.

Estimates of cost savings associated with the actions were calculated, based on a preliminary assessment of available information. The anticipated emission savings attributed to each action were also estimated.

Some action reductions were calculated on the national indexes and some based on benchmarking. The reduction values were compared to the 2018 emission inventory of the entire city. In addition to the quantified benefits, other potential benefits include improved health of residents, climate change city's resilience, air quality improvements, increase in biodiversity and aesthetic value, social integration, increase in land value and prosperity, economic development and improvement of access to services. These benefits were also reported, where applicable for each action.

#### Review and confirmation

Once developed, actions were reviewed through a next round of stakeholder workshops, in order to revise and confirm the list of actions to be included within the GCCAP.



Photo: Valentyn Chernetskyi, Unplash

## 2. GCCAP preparation approach

### 2.3 Stakeholder engagement

#### Stakeholders

The developed GCCAP document was subject to consultation with a wide range of local stakeholders. Stakeholders were identified by the Consultant in cooperation with the city. Stakeholders from various sectors were selected, representing interests at the local and national levels.

Selected stakeholders come from the city structures, NGOs, academia, private sector and civil society (including groups especially sensitive).

The selection of stakeholders was diverse, inclusive and representative of the key groups in the city and region, ensuring inclusiveness and social diversity.

#### Stakeholders engagement

During the GCCAP preparation process, stakeholders attended multiple working sessions, some with over 80 participants and the launch event with more than a few hundred viewers. Stakeholders made a significant contribution to the process of developing the Green City and Climate Action Plan of Warsaw by identifying specific needs of the city and opportunities for implementing solutions to meet those needs. Collaboration has made it possible to identify units that can participate in the implementation of the GCCAP assumptions.

To present the current stages of project preparation along with informing and enabling citizens to contribute to the project, we used the **Virtual Engagement Room**. This was an online space where shortened versions of news and documents were published for the citizens' review and comment.

#### Stakeholders engagement process

During the preparation process of the GCCAP, stakeholders were engaged in the following ways:

- **Launching the GCCAP:** city kick-off meeting and launch event to introduce the city and wider public to the GCCAP process. The inception workshop was the first to discuss city needs and challenges.
- **Baseline assessment:** During the data collection for the baseline assessment purpose, the consultant held different one-to-one and small groups sessions to collect the data and understand the city challenges.

**Table 1. Stakeholder engagement process**

Stakeholder Engagement			
City kick-off meeting	Launch event	Inception workshops	Prioritising of challenges
Steering committee meeting	Vision and Objectives Workshops	Action shortlisting workshops	Bilateral sectoral meetings
Social media	Virtual Engagement Room	Vimeo streaming	Outdoor poster

## 2. GCCAP preparation approach

### 2.3 Stakeholder engagement

#### Stakeholders engagement process cont.

- **Prioritisation of challenges:** at the end of the baseline phase, the internal and external stakeholders were engaged to prioritise the challenges. Based on the workshops a prioritisation statement was published (the most important challenges) with selection of short-term objectives included in the Green City and Climate Action Plan of Warsaw described for each sector. The prioritisation statement was presented to the Steering Committee for approval.
- **Vision and scenarios for climate action:** the next series of workshops aimed to discuss ambitious and extended emission reduction pathways in the perspective of 30 years and to agree on the reduction values resulting from these pathways.
- **Action development:** the set of actions reviewed earlier by the City Coordination team, C40 and EBRD. The actions were evaluated out of a longlist and were presented as a suggested shortlist of GCCAP actions.

Prior to the workshops the shortlist of actions was sent out to the participants of the workshops and was posted on the **Virtual Engagement Room**;

- **Action shortlisting workshops:** the short-list was presented to the external and internal stakeholders at the workshops. During each of the them, experts presented actions for each sector and held a discussion on suggested amendments. After the workshop the actions were amended according to the comments.



Photo: City of Warsaw

## 2. GCCAP preparation approach

### 2.3 Stakeholder engagement

**Table 2. Details of meetings and workshops conducted with stakeholders**

Stakeholder Engagement	Rezultaty prac	Number of attendees	Dates
Kick-off meeting	Presentation of the GCCAP project in the city Establishment of principles of cooperation and timetable for the GCCAP	Internal - approx. 50	25 November 2020
Launch event	Presentation of the GCCAP project to stakeholders Building relationships and stakeholder engagement	approx. 240 (210 – on Polish channel; 30 – on English), over 1000 views on Vimeo	5 December 2020
Inception workshops	Collection of relevant information on the existing state of the city from stakeholders Identification of specific needs and challenges in the city	approx. 15 participants in each group (about – approx. 60)	2–4 February 2021
Prioritising of challenges	Assessment and prioritisation of identified challenges in terms of importance	External – approx. 35 Internal – approx. 60	27 May–14 June 2021
Workshops – II	Agreeing on a vision and detailing short-term objectives	Internal – approx. 60	7–16 July 2021
Steering Committee – I meeting	Approval of short-term objectives	Internal – approx. 40	8 September 2021
Workshops – III	Presenting the scope of a shortlist of activities, collecting opinions and ideas from stakeholders	External – approx. 20 Internal – approx. 80	3–10 November 2021
Individual meetings with representatives of Warsaw City Hall offices and city companies	Collection of relevant data and information from stakeholders to refine action objectives Agreeing on the scope and competent entities for the implementation and realisation of the action objectives	Internal – approx. 20	May – August 2022
Steering Committee – II meeting	Final agreements on scopes of action Approval of the assumptions of the Green City and Climate Action Plan of Warsaw	Internal – approx. 40	10 August 2022

## 2. GCCAP preparation approach

### 2.3 Stakeholder engagement

#### Stakeholders

NGOs, which represent various groups of people and interests are key stakeholders in the project. Active NGOs in Poland<sup>3</sup> were mapped and those whose core activity is complementary with the project scope were chosen. The list includes representatives working on:

- climate change,
- air pollution,
- environment protection,
- building,
- architecture & infrastructure.

Moreover, we identified vulnerable or hard-to-reach groups, e.g., elderly, youth, ethnic minorities, low-income groups. Among others we included two NGOs in transport and building groups that take care of people with disabilities and women-focussed NGOs. Both women and men are represented in the NGOs sector in Poland. According to Statistic Poland Office in 2018 over 74% of the NGOs workforce were women<sup>4</sup>.

Table 3. Areas of stakeholder engagement

Stakeholders			
<b>Sector</b>			
Air pollution & climate change	Water, green space & biodiversity	Buildings and architecture	Energy infrastructure
<b>Who</b>			
NGOs	NGOs and universities	NGOs, universities, architects' associations	Business and energy agencies, NGOs
<b>Subject area</b>			
Solid waste	Transport	GCCAP document and actions	
<b>Who</b>			
Businesses and NGOs	Businesses, state institutions and NGOs	Internal and external stakeholders invited to the workshops Citizens and media invited to participate via Virtual Engagement Room	

## 2. GCCAP preparation approach

### 2.3 Stakeholder engagement

During the document preparation a Stakeholder Engagement Plan was created and updated with the description of activities undertaken (available on the website: [www.ebrdgreencities.com](http://www.ebrdgreencities.com)).

#### Next steps

The final, important step for the development of this document will be a formal public consultation, where all citizens are welcome to add their comments and insights.

The GCCAP is a strategy that will be developed by the implementation of targeted actions. The city will continue engaging stakeholders in the future on the next steps of development and action implementation. The city wishes to continue cooperation with its citizens in the future steps of implementation of the Green City and Climate Action Plan.

**Table 4. Groups of stakeholders involved in the process of preparing the Green City and Climate Action Plan**

Involvement and representation of different groups			
Gender: Women/Men	Persons with disabilities	Older people	Youth and children
<p>During the workshops, care was taken to maintain the balance between female and male representatives.</p> <p>Additionally two NGOs dealing with womens' rights, political and social movement for women were invited to participate in the workshops.</p>	<p>During stakeholder workshops, two NGOs were invited within the transport and buildings sessions who work directly with persons with disabilities in Warsaw and therefore were able to provide inputs that reflect the experience, needs and expectations of this group.</p>	<p>During stakeholder workshops, we asked all participants about issues related to access to public transport and municipal buildings for older people.</p> <p>NGOs representing this groups were invited to participate in the external stakeholder workshops.</p>	<p>A Virtual Engagement Room platform was created to play to the digital strengths of this group. The City has undertaken a social media campaign to raise awareness about the GCCAP. The youth NGOs group was invited to participate in the external workshops.</p>



# 3. Assessment of the existing state of the city



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## 3. Assessment of the existing state of the city

### 3.1 Policy and socioeconomic baseline

#### Governance

**Administrative structure.** Warsaw is the capital city of Poland and the administrative centre of the Masovian Voivodeship, the largest and most populous of Poland's 16 provinces. The decision-making and controlling body is the Warsaw City Council, consisting of 60 councilors elected in local government elections. Thus, the Council is a legislative body, while the Mayor of the Capital City of Warsaw is the executive body. The Mayor manages the day-to-day affairs of the city and represents the city externally.

Organisational Chart of the Office of the City of Warsaw presented on page 139.

Warsaw is a 'Gmina' (in English: commune or municipality) but due to its size and administrative importance is treated as a 'Powiat' (in English: county or district); this means that the City has public administration functions at both the commune and poviats level. Warsaw is made up of 18 districts, each of which has its own budget and district mayor, who are responsible for local matters including housing, education, social welfare and partly for cultural, sports activities and green areas located in the area.

**Responsibilities.** The Municipal Office of the City of Warsaw contains departments dedicated to include the environment, waste management and climate change, including in particular: Environmental Protection Department, Municipal Waste Management Department, Air Protection and Climate Policy Department. There are also units working with social issues, actions in the field of counteracting discrimination of various social groups and ensuring accessibility and security, such as: the Centre for Public Communication (especially the Equal Treatment Department), the Welfare and Social Projects Department (in particular the Accessibility Division) and Supervision Department (in particular the Team for Social Affairs), as well as accessibility coordinators operating within the Departments of the Municipal Office and District Departments. Also, particularly relevant to the GCCAP are the Infrastructure Department, Housing Policy Department, European Funds & Development Policy Department, Architecture & Spatial Planning Department, Economic Development Department, the Board of Greenery of the Capital City of Warsaw, the Municipal Roads Authority, the Public Transport Authority, the Municipal Water and Sewerage Company in the Capital City of Warsaw Joint Stock Company and the Debt & Receivables Department.

**City powers.** Mayoral power is relatively high in terms of setting and enforcement of different policies i.e., dedicated to public transport, city roads, public buildings, urban land use and others, as well as budgetary, revenue control in the sectors indicated. The Mayor executes the resolutions of the municipal council and the tasks of the municipality specified by law. The Mayor's tasks include: preparing draft resolutions of the municipal council, preparing development programmes in accordance with the procedure set out in the regulations on the principles of development policy, determining the manner of implementing resolutions, managing municipal property, implementing the budget, employing and firing heads of municipal organisational units. In municipal companies, the Mayor is the entity empowered to execute shareholding rights (see Table 5).

Council of the Capital City of Warsaw is a decision-making and control body. They decide about the most important matters of the city and supervises the activities of the Mayor. The work of the council is managed by the Chairman elected from among its members, who together with the Vice-presidents form the Presidium of the Council.

### 3. Assessment of the existing state of the city

#### 3.1 Policy and socioeconomic baseline

Table 5. Warsaw mayoral powers assessment updated in 2022

	Own and operate	Set and enforce policies	Budgetary and revenue control	Set vision
Private buildings	Not applicable	Limited powers	Limited powers	Limited powers
Public buildings	Strong powers	Strong powers	Strong powers	Strong powers
Energy supply	Limited powers	Limited powers	Limited powers	Limited powers
Finance and economy	Limited powers	Limited powers	Limited powers	Limited powers
Public transport	Strong powers	Strong powers	Strong powers	Strong powers
City roads	Strong powers	Strong powers	Strong powers	Strong powers
Urban land use	Strong powers	Strong powers	Strong powers	Strong powers
Waste	Limited powers	Strong powers	Strong powers	Strong powers
Agricultural land	Not applicable	Limited powers	Not applicable	Limited powers
Urban green areas	Strong powers	Strong powers	Strong powers	Strong powers
Urban Forests	Strong powers	Strong powers	Strong powers	Strong powers
Water and sewage system	Limited powers	Limited powers	Limited powers	Limited powers

Not applicable
  Limited powers
  Partial powers
  Strong powers

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## 3. Assessment of the existing state of the city

### 3.1 Policy and socioeconomic baseline

#### Socioeconomic context

**Demographics.** Warsaw has approximately a population of 1.86 million, the largest of Poland's Cities (2021)<sup>5</sup>. Urbanisation is leading to population growth in the city. It is expected to grow to 2,225,000 inhabitants in 2050.<sup>6</sup>

It is estimated that by 2050 25% of Warsaw's population will be at retirement age (currently it is 18%).<sup>7</sup> The unemployment rate in Warsaw is very low at 1.8%. The number of unemployed men is higher (52% of men as compared to 48% of women) in the total number of registered unemployed. The largest group of the unemployed includes qualified individuals – the percentage of the unemployed with university degrees is 31.2%, mainly the people over 50 years of age<sup>8</sup>.

In 2021, 2% of Warsaw's population were registered as foreign nationals, of which the majority were Ukrainians. Since the start of the Ukraine war in February 2022, displaced people from Ukraine have entered Warsaw in unprecedented numbers.

The City has calculated that even half a million refugees were passing Warsaw in recent months to other destinations and about 300,000 of people have stayed in the city or in the suburbs<sup>9</sup>.

**Economy and industry.** Before the COVID-19 pandemic Poland recorded robust growth, averaging 3.6% between 2010 and 2019 (compared to the 1.6% EU average)<sup>10</sup>.

Warsaw is the largest economic centre in Poland, contributing 13.6% of national GDP and one of the most important centres of economic activity in the region of Central and Eastern Europe.

The services sector represents 84% of the city's economy, of which the majority falls into financial services and Warsaw is at the top of the EU market for Foreign Direct Investment. Manufacturing makes up just 5% of GDP.

Agricultural land makes up 13% of land within Warsaw's boundaries, though this figure is declining over time (Environmental Protection Programme for the City of Warsaw for 2021-2024).

The highest share of employment is observed in the sectors of trade (21.6%), transport and warehouse management (19.9%) based on the Polish Classification of Activities<sup>11</sup>.

The COVID-19 pandemic has had an extensive impact on the economy of the city, including the long-term disruption of ways of work, such as shifting to remote access.

**Municipal finance.** The budget is adopted by the Warsaw City Council at the request of the Mayor. Thereafter, the Mayor presents a report on budget execution, the City Council again takes over control of the budget. The supervisory authority is the Regional Chamber of Auditors. Revenues consisting mainly of a fixed share of national income taxes, local taxes and subsidies from the state budget, while expenditures largely depend on its own operations, complemented by investments.

The international market is increasingly seeing Warsaw as an attractive place to invest. According to Financial Times special report "10 European Cities and Regions of the Future 2020/21", Warsaw ranks sixth as one of "the best and the brightest among Europe's investment destinations". Warsaw has been singled out for its cost effectiveness, business friendliness and economic potential.

## 3. Assessment of the existing state of the city

### 3.1 Policy and socioeconomic baseline

#### Socioeconomic context cont.

**Municipal finance cont.** Public-private partnerships (PPPs) and the mobilisation of private capital will be important in order to fully realize the potential of the GCCAP actions and shape the sustainable development of Warsaw.

However, the city's budgetary position has deteriorated in recent years. As a result of tax changes, the income of the local government decreased with the simultaneous increase in the number of functions and higher operating costs (energy prices).

**Access to services.** Direct water supply and sewage collection is available to 99% and 96.8% of Warsaw's inhabitants, respectively (2020). Approximately 73% of the city's homes have access to the gas network<sup>12</sup>. Around 55% of the city is supplied by the municipal heating network (2019) and 80% of residents use district heat, which is produced mainly by high-efficiency cogeneration plants<sup>13</sup>.

Access to public transport in Warsaw is good. There are 376 km of tram routes, a 42 km underground network, 141 km train network and almost 3,000 km of bus routes (2020)<sup>14</sup>.

There are also 676 km of cycle paths and 16 Park-and-Ride facilities for drivers (2020)<sup>15</sup>.

The inhabitants of Warsaw highly appreciate the level of safety in public transport and public space<sup>16</sup>. Public transport is highly adapted to the needs of the elderly, people with disabilities, parents with children – buses and trams are low-decked and have special seats, platforms and solutions facilitating communication of people with limited mobility. Public health services in Warsaw are constrained with staff shortages and limited hospital beds. Access to health infrastructure is better in Warsaw than in Poland on average, although there is disparity between districts.

**Citizen engagement.** In 2018 there were over 100,000 active NGOs in Poland, 10% of which were registered in Warsaw. Many green and climate related initiatives have emerged in recent years<sup>17</sup>.

In 2020, the Warsaw Climate Panel was carried out, the aim of which was to include residents in the city's decision-making processes.

The Panel put forward a set of recommendations for climate action, including increasing the energy efficiency and share of renewable energy sources in the city, and has since prepared an implementation roadmap<sup>18</sup>. The links between the actions developed in the GCCAP and the recommendations of the Warsaw Climate Panel are shown in [Table 27](#) in Appendix B Review of applicable regulations and development programming documents.



Photo: Marcin Lukasik, Unsplash

## 3. Assessment of the existing state of the city

### 3.1 Policy and socioeconomic baseline

**Citizen engagement cont.** Warsaw has a history of strong public engagement and is full of young, proactive people, who are committed to improve the state of their city. Throughout the GCCAP process we have included these voices to ensure that our Plan reflects the needs of our city.

Many initiatives at the national and municipal level, such as Warsaw Climate Panel and the numerous NGOs operating on the territory of the City, contribute to the development of a greener and more sustainable city.

#### Social and gender considerations

Table 6 presents a summary of the considerations of vulnerable groups, which are important to be addressed in the GCCAP actions.

The social prioritisation focused on energy poverty. While energy efficiency retrofit could help to reduce energy costs for residents, changes in the energy mix and increase of the cost of renewable energy could lead to the unintended consequence of deepening of the wealth polarisation of the society.

Avoiding such unintended consequences depends on good program and project design and financing solutions consistent with just transition principles.

#### Gender

In the development of the city, it is important to ensure inclusivity and social integration. A key common issue among various sectors was the lack of data needed to assess the differences in the accessibility of using different city infrastructure. A good gender and social study would allow verification of whether the city services are adjusted to the needs of all groups equally.

#### Accessibility

The accessibility of city services and public buildings for disabled people was also discussed. This issue was identified as mostly resolved by the city accessibility guidelines but there are areas where improvement is needed, as well as constant communication and education in this area.



Photo: City of Warsaw

### 3. Assessment of the existing state of the city

#### 3.1 Policy and socioeconomic baseline

**Table 6. Vulnerable groups and their needs, which are important to be addressed in the GCCAP actions**

Group	Definition of group	Description of vulnerability
<b>Gender: Women/Men</b>	People who in certain circumstances are in a difficult situation owing to their physical characteristics and specific needs or who are at risk of being excluded from financial and social services.	The Polish Constitution states that everyone is equal before the law and nobody may be discriminated against in political, social or economic reasons (art. 32). Women and men have equal rights in family, political, social and economic life (art. 33). Despite these statements, in 2020 Poland ranked 24th in the EU on the Gender Equality Index with significant gap in power (decision making) and time (allocation of time for domestic activities, care and social involvement). The unadjusted gender pay gap is among the lowest in the EU (2018: Poland – 8,5%, EU-27 – 14,1%), however, large cross-industry discrepancies are observed (sectors with gap exceeding 30%). The employment rate in Warsaw was 68.2% - 75.2% for men and 61.1% for women in 2020 <sup>19</sup> .
<b>Older people</b>	People who have reached the general retirement age (from 1 October 2017 it is 60 for women and 65 for men).	Older people are typically more vulnerable to climate change impacts. Typically, older people and in particular those over the age of 75, face more significant impacts from pollution and extreme weather events such as heat waves, flooding and storms. With the growing population, especially in the outer districts, there is a need for development of urban services, including transport and education facilities, as well as proper management of green areas for young and elderly.
<b>Persons with disabilities</b>	People who have long-term physical, mental, intellectual or sensory impairments, which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others.	Persons with disabilities are globally among the most at-risk to climate change impacts, due to interacting factors that can limit their capacity to respond and recover from extreme weather events and adapt to changing environments. Taking into account the requirements of universal design, the city is implementing solutions to improve infrastructure accessibility of transport infrastructure and in public spaces. In transport there are specialized transport services for people with disabilities. The service is provided in the capital city for people with disabilities, who can travel alone with a guardian or a guide dog. The city has accessibility Standards for the Capital City of Warsaw, binding for all municipal investments commenced after the introduction of the ordinance in 2017. In the case of public spaces, including green areas, the new projects will meet the rules requirements, e.g. in terms of the width of the routes, the surfaces used, and the arrangement of benches.

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## 3. Assessment of the existing state of the city

### 3.1 Policy and socioeconomic baseline

**Table 6. Vulnerable groups and their needs, which are important to be addressed in the GCCAP actions**

<b>Group</b>	<b>Definition of group</b>	<b>Description of vulnerability</b>
<b>Youth</b>	People aged between 15-24 years old	<p>Air pollution causes respiratory conditions.</p> <p>In cities like Warsaw, young people often commence their early career at the university, taking advantage of student internships and other opportunities present in urban business centers. A large portion of students in Warsaw come originally from different regions of Poland looking for their future in the capital city.</p> <p>With growing population, especially in the outer districts, there is a need for development of urban services, including transport and education facilities, as well as proper management of green areas for young and elderly.</p>
<b>Children</b>	People under the age of 15 years old	<p>Children and in particular those in early childhood have a limited capacity to respond and recover from extreme weather events and adapt to changing environments and therefore, are particularly vulnerable to climate change impacts. Similarly to youth, children will experience increasingly severe climate change impacts over the course of their generation's lifetime and therefore should play a role in the decision-making that will impact their future.</p> <p>Approx. 214 per each 1000 children were enrolled to the nurseries and children's clubs (below 3 years old), while 730 per each 1000 inhabitant children (3-6 years) old were enrolled to the kindergartens<sup>20</sup>.</p>

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### 3. Assessment of the existing state of the city

#### 3.1 Policy and socioeconomic baseline

**Table 6. Vulnerable groups and their needs, which are important to be addressed in the GCCAP actions**

Group	Definition of group	Description of vulnerability
<b>Informal and/or low-income workforce/ or affected by energy poverty</b>	People who work in informal or casual employment, without formalised employment contracts or benefits or people, who earn less than the national minimum wage on an annual basis or those, who have difficulty meeting its energy needs (heating, hot water, electricity) due to low income or housing characteristics.	<p>This group are likely to have relatively low financial and job security, meaning that they are more vulnerable to events which alter labour demand, including any economic shocks, which may result from climate change impacts.</p> <p>People in this group can also face unequal access to services such as healthcare and insurance, and therefore can have a lower capacity to adapt to and recover from climate change impacts. They may also have a greater susceptibility to the impacts of air pollution.</p> <p>NOTE: In 2016 it was evaluated that even 12.2% of Polish residents were affected by energy poverty. Currently rising inflation and war translate into intense increases in the prices of services, food, imports and Energy, which may contribute to aggravating the disparities in the development of society<sup>21</sup>.</p>

### 3. Assessment of the existing state of the city

#### 3.1 Policy and socioeconomic baseline

**Table 6. Vulnerable groups and their needs, which are important to be addressed in the GCCAP actions**

Group	Definition of group	Description of vulnerability
<b>Migrant populations</b>	<p>People who have moved to Warsaw from a previous country of residence.</p> <p>There were 90,000 registered migrants in the Mazowieckie voivodeship in 2021. Almost half of the migrant population living in Poland are from Ukraine and Belarus. More than half are men with typical employment in construction, transport and other manual labour.</p>	<p>Due to robust growth and increasing cross-border wage gap, Poland became attractive for immigrants - especially since the introduction of the simplified permit procedure for citizens of six Eastern countries. The estimated number of foreign workers in 2019 was up to 1.5 million, of which approx. 80% were Ukrainians. A comparable number for Warsaw was not available, however 68,228 permits were issued to foreigners in 2020, of which 65.6% to Ukrainians. Most immigrants employed in Warsaw still perform menial jobs (57%), but their role as service workers or specialists is increasing. A significant share plan to stay in Poland for a longer period (Warsaw: 52% above 3 years)<sup>22</sup>. According to the estimates, Ukrainian migrants in Poland contributed to 0.5 pp. of yearly growth rate between 2013 and 2017.<sup>23</sup></p> <p>NOTE! Due to Russia's invasion of Ukraine, war started on February 24, 2022 it is estimated that in a month about 2 ml. people left Ukraine and crossed Poland's border. Recent publications indicate a 17% growth of the city population. The City has calculated that even half a million refugees were passing Warsaw in recent months to other destinations, and about 300,000 of people have stayed in the City and the suburbs<sup>24</sup>. This results in an increased demand for housing, for access to education and medical services. This creates an increase in demand for housing, access to education and medical services. The development of the situation and future, further needs are uncertain. Many people fleeing the war declare their willingness to return to their homeland after the end of the conflict.</p>

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## 3. Assessment of the existing state of the city

### 3.1 Policy and socioeconomic baseline

#### **Green City and Climate Action Plan of Warsaw and development planning documents**

Since 2018, the development of the City of Warsaw proceeds as intended with the #Warsaw2030 Strategy. The strategy defines a vision for the city's development in three dimensions:

- active citizens,
- a friendly place,
- open metropolis.

Warsaw aims to achieve climate neutrality by 2050. In line with the Covenant of Mayors framework and as a member of C40 Cities, it has committed to further interim targets to reduce carbon dioxide emissions by 40% by 2030 against a 2007 baseline.

A key implementation document for the "Strategy #Warsaw2030" is the Environmental Protection program for the City of Warsaw for 2021–2024, approved in April 2021.

This document is a crucial part of the new "city-as-ecosystem" strategic framework, in which the environment is seen as a fundamental element of urban wellbeing, and policies are designed to benefit from interrelations, positive feedback loops and synergies.

Warsaw is also planning to adapt a Sustainable Energy and Climate Action Plan (SECAP), which will contain policies regarding the commitment for the CO<sub>2</sub> reduction of 40% by 2030 and the implementation of relevant adaptation measures (additional to the mitigation actions). The SECAP will concentrate on measures aimed at reducing GHG emissions and the final energy consumption by end users, as well as include adaptation actions in response to the impacts of climate change. SECAP will be build based on the GCCAP evidence.

The development of the SECAP will primarily draw on the findings from the Baseline Emission Inventory (BEI) carried out in 2018 and the Climate Change Risk and Vulnerability Assessment (RVA) methodology.

The monitoring of the implementation of SECAP, CAP and GHG emissions in the the Global Protocol for Community Scale Emission Inventories methodology (known as the GPC) will be linked. Both documents will be monitored in a 2-year cycle. Many other areas to be covered in the GCCAP are also strongly related to other sectoral policies and programs of the city such as:

Integrated Revitalization program by 2022 (from 2016), Environmental Protection program against Noise for the City of Warsaw (from 2018), Long-term Plan for the Development and Modernization of Water Supply Equipment and Sewerage Equipment for the years 2022-2030 and others. These documents are regularly updated, which should be taken into account when carrying out tasks. Only their substantive coherence and consistent implementation can bring desired results.

The city has signed the European Charter for Gender Equality in Local Life (in 2021) and the LGBT+ Declaration (in 2019). Warsaw implements a program of combating discrimination and equal opportunities, a program of supporting the development and ensuring safety, as well as equal access for women to health care and education. The Warsaw Women's Council was established in the city.

### 3. Assessment of the existing state of the city

#### 3.1 Policy and socioeconomic baseline

##### Green City and Climate Action Plan of Warsaw and development planning documents cont.

As Poland is an EU member state and signatory to many international agreements and conventions, such as UNFCCC, UNECE, UNCBD and others, the GCCAP has been designed to align with and make progress towards these national level commitments.

In the Appendix A action description details are presented.

The section: "Enabling actions within the Green City and Climate Action Plan of Warsaw" includes a list of links between individual actions. Additionally, in part: "Enabling policies and actions" connections of selected national and city policies related to the actions of the GCCAP are presented.

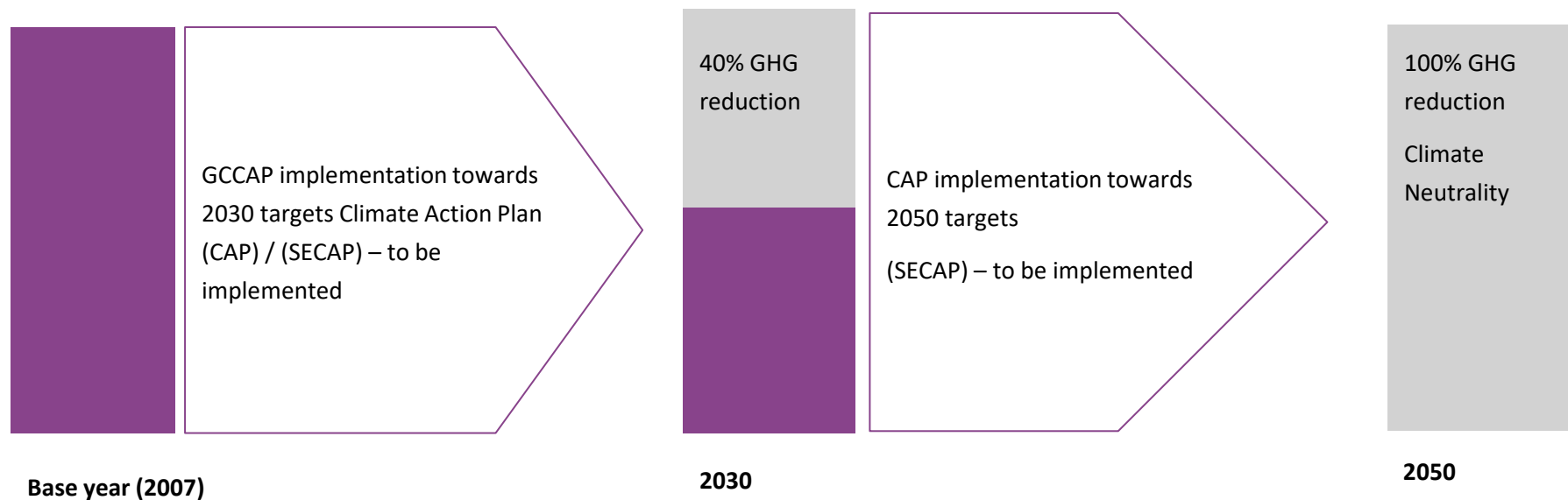


Figure 7. Roadmap for the achievement of the reduction target for CO<sub>2</sub> for 2030 and 2050

### 3. Assessment of the existing state of the city

#### 3.2 Environmental baseline. Assessment of the existing state

This section provides an overview of the environmental baseline, summarising the data collection process, the key findings in terms of the environmental challenges, opportunities within Warsaw and the urban systems, and land use pressures that influence the city's environmental condition.

#### Indicator database

As part of the city baseline, a database of 122 indicators was developed in order to gain an overall picture of the current state of Warsaw's environment, guided by the EBRD Green Cities program Methodology.

Of the indicators collected:

- 18 were within the red benchmark range, indicators value was worse than the reference range;
- 29 were in the yellow range, indicators value was within the acceptable range;
- 54 were in the green range, indicator value was better than the reference range;
- 21 were not compared with the indicators due to insufficient data for their evaluation.

#### Key findings

- Air pollution, notably high concentrations of PM<sub>2.3</sub> in the red benchmark range (over 20 µg / m3).
- High levels of ammonium (NH<sub>4</sub><sup>+</sup>) (over 0.2 mg/l) and biological oxygen demand (BOD<sub>5</sub>) (over 4 mg/l) in surface water.
- PM<sub>2.5</sub> (over 20 µg / m3) and NO<sub>x</sub> (over 80 µg / m3) are in the red benchmark range and their levels are not improving in recent years.
- Warsaw's per capita GHG emissions are within the yellow benchmark range, at 6.8 tCO<sub>2</sub>e/capita.
- Warsaw's climate is rapidly changing and flooding, urban heat and drought represent important concerns.
- Share of parks, lawns, the green areas in housing estates and protected areas within the city limits is at the level of 30% and is in the "yellow" range (based on Emerging and Sustainable Cities Program (ESC) of the Housing and Urban Development Division of the IDB).
- Indicator of the area of green open area (areas of parks, lawns and estate green areas as well as areas of protected areas) per 100k residents is in the "green" however it is important this is protected against future development.

### 3. Assessment of the existing state of the city

#### 3.2 Environmental baseline. Assessment of the existing state

##### Environmental baseline. Assessment of the existing state cont.

Based on the information gathered in the process of analysing the initial state of the city and discussions during the consultation process of the results of the analyses, the prioritisation of the city's environmental challenges was carried out together with the workshop participants. In this way, 5 priority sectors were selected along with key environmental priorities (Figure 8).

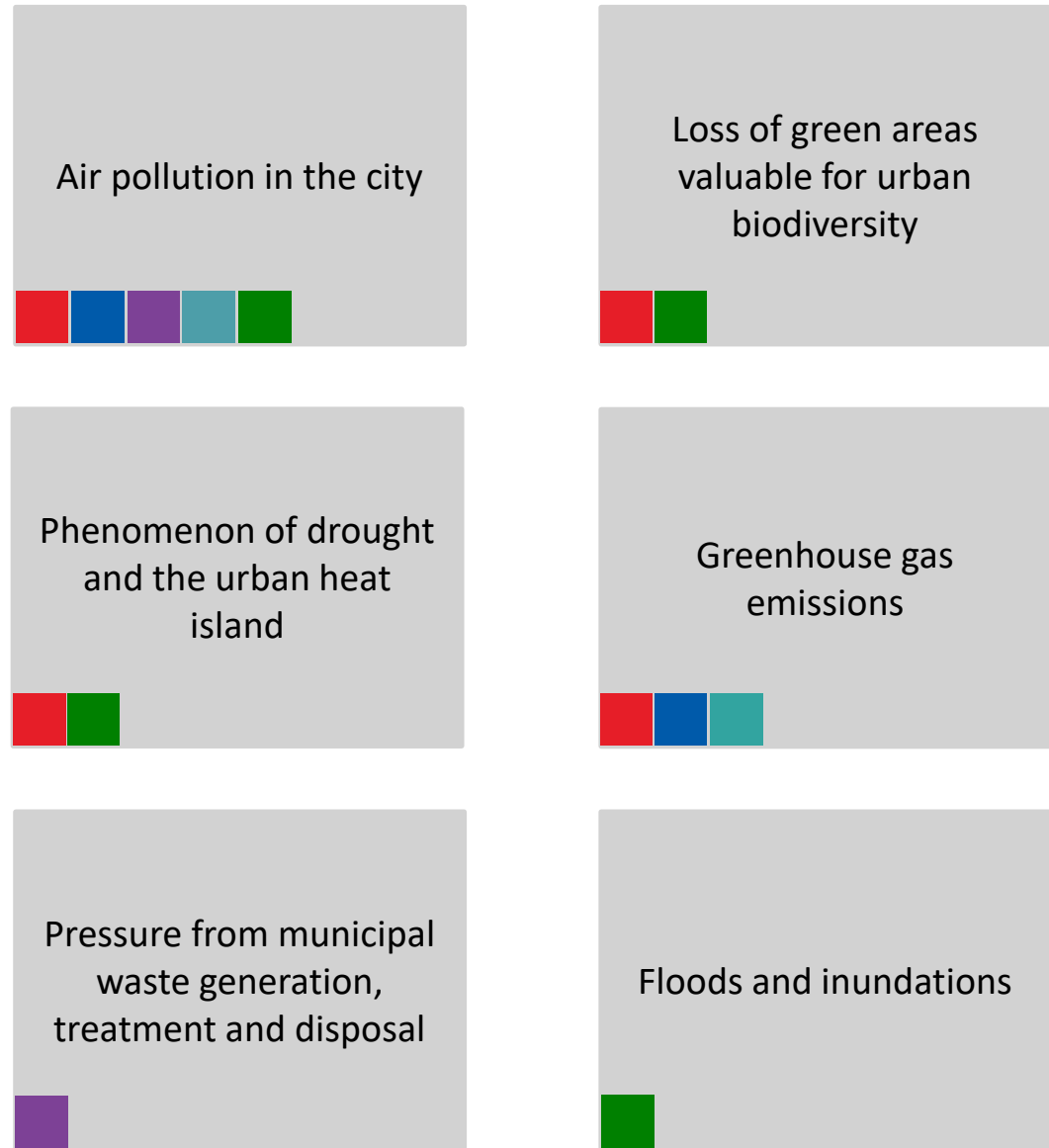
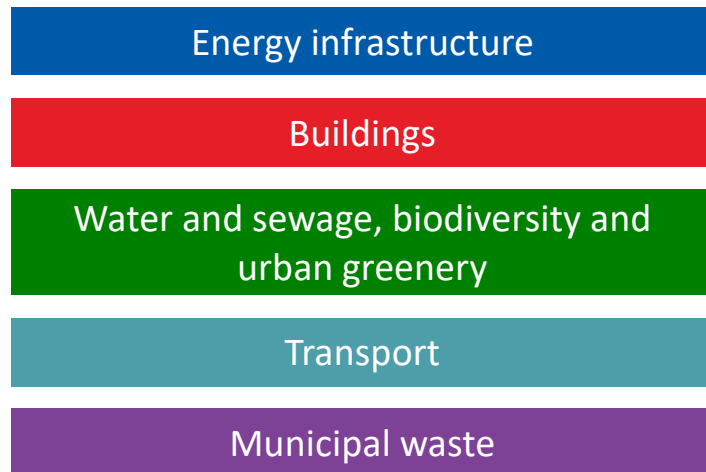


Figure 8. Priority sectors and environmental areas

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## 3. Assessment of the existing state of the city

### 3.2 Environmental baseline. Assessment of the existing state

#### Air quality

Warsaw suffers from significant air pollution issues, largely due to road traffic in the city centre together with coal and wood-fired heating in the outer districts, as well as to a lesser extent airborne dust.

A significant amount of pollution comes from influxes from outside Warsaw's borders (benzo(a)pyrene, particulate pollution).

NO<sub>2</sub> concentrations in the city are above the threshold of the benchmark range, as a result of traffic and, in particular, the significant share of private cars in transport. PM<sub>2.5</sub> and PM<sub>10</sub> concentrations are also high, attributable to building heating systems (heat sources for solid and oil fuels - individual coal and wood-based heating), transport (abrasion of tires, brake pads, use of diesel vehicles) and secondary dusting (rising air of dust accumulated on the road surface).

Between 2015-2018, PM10 concentrations exceeded Polish standards, however in 2019-2021 their annual average concentrations were within the standards.

On the other hand, the standards for PM<sub>10</sub> were exceeded with regard to the permissible number of days exceeding the daily standard.

PM<sub>2.5</sub> concentrations are still higher than the limit and the levels of these pollutants are not declining.

Sulphur concentrations are not a concern within Warsaw, owing to the installation of flue-gas filtration systems on large heat and power plants and the lack in local heavy industry<sup>25</sup>.

#### Climate change resilience

A very high percentage of Warsaw's infrastructure and households are considered 'at risk' to climate change related hazards, due to the risk of extreme heat and flooding hazards<sup>26</sup>:

- 60% of residential buildings are considered to be at high risk;
- 84% of the area of public infrastructure, in relation to the total area of roads and buildings in the city is considered to be exposed to high risk.

This is a high rate compared with a 20% red benchmark

Local flooding and extreme high temperatures represent the most significant risk categories for Warsaw. About 66% of residents are exposed to an increased risk of severe heat.

The risks associated with high temperatures are mainly exposed to the elderly (over 65), young children, people with respiratory and cardiovascular diseases, people with disabilities, mainly physical disabilities and the homeless.

Downtown districts (Śródmieście, Ochota, Wola, Mokotów) and the southern part of Praga-Północ and the western part of Praga-Południe are the worst in this regard.

19% of inhabitants are exposed to an increased risk of flooding and floods due to increased frequency and intensity of rainfalls and impervious surface area, this is especially true of the districts in the south of Warsaw and the city center, 29% residents are exposed to an increased risk of flooding, floods and severe heat<sup>27</sup>.

Warsaw also has an Urban Adaptation Plan (Climate change adaptation strategy for the Capital City of Warsaw by 2030 with a perspective by 2050), that was adopted in 2019, which presents the analysis of climate changes influence at the city with spatial presentation on the city map, presents priorities and actions which need to be implement to systematically build the resilience of the city and residents to the effects of climate change and adapt to new climate conditions<sup>28</sup>.

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## 3. Assessment of the existing state of the city

### 3.2 Environmental baseline. Assessment of the existing state

#### Water quality and resources

Ammonium ( $\text{NH}_4^+$ ) concentration in surface waters is significantly high, although 2019 reflects a sudden spike compared to previous years, the concentration was within the green benchmark range. Biochemical Oxygen Demand (BOD) in surface waters is slightly higher than the red benchmark value, as is relatively constant. This characteristic relates to the surface waters of the Vistula River and is the result of the activities of localities located upstream of the river. Drinking water is of a high quality with almost 100% meeting potable standards<sup>29</sup>.

The city does not collect data on the water exploitation index that would define the mean annual total demand for freshwater divided by the long-term average freshwater resources. It gives an indication of how the total water demand puts pressure on the water resource. However, for Poland this value is estimated at 17.6%, which shows a good condition<sup>30</sup>.

#### Soil quality

The quality of soils in Warsaw is assessed as good, in the case of post-industrial areas, improvement is achieved through reclamation or remediation, taking into account the standards applicable to the introduced functions that these areas will perform.

However, Warsaw still has degraded and contaminated soils in post-industrial and communication areas, although the city is dominated by areas with a low level of land contamination. Within industrial and communication areas, the permissible concentrations of metals (mainly Zn, Cu, Pb) were exceeded for approximately 0.65% of soils and of organic compounds (the sum of DDT compounds) for over 4% of soils<sup>31</sup>. Currently, there is a register of historical pollution of the earth's surface, however, still an important issue is the lack of up-to-date and complete recognition of soil and ground contamination in the city, which determines the risk of locating new residential and service buildings in excessively contaminated areas. For this reason, as part of the Environmental Protection Programme for the Capital City of Warsaw for 2021-2024, it is mandated that, in the process of issuing environmental decisions, soil and ground investigations should be carried out even before the commencement of the project. An assessment of the degree of soil contamination and the suitability of the surveyed area for the implementation of the intended projects is required. On the other hand, the execution of the investment itself is allowed only after the appropriate soil and land quality standards have been achieved<sup>32</sup>. In recent years, there has been a positive improvement in the conduct of investors in this respect.

#### Biodiversity and naturally functioning areas

Warsaw is one of the greenest European capitals in terms of coverage of green spaces and forests. The share of green areas, forests, agricultural and post-agricultural areas, as well as undeveloped areas constitutes a total of 44.4% of the urban area.<sup>33</sup> Uncontrolled urbanization pressure poses a threat to the continuity of the city's natural system and biodiversity. The spreading of buildings to the outskirts may have a negative impact on the aerosanitary conditions in the city due to the occupation of areas for air exchange and regeneration. Currently undeveloped areas are mostly unprotected and represent an opportunity for sustainable design to enable development to meet the needs of a growing city, while retaining areas of high biodiversity and significant aesthetic values. Warsaw has a high proportion of protected Natura 2000 areas (5% of the city area). There are many forms of nature protection, which together cover over 27% of the city's area.

Through the area of the capital city in Warsaw, there are two ecological corridors of national rank, which are part of the North-Central Corridor of international rank<sup>34</sup>.



### 3. Assessment of the existing state of the city

#### 3.2 Environmental baseline. Assessment of the existing state

##### Biodiversity and naturally functioning areas cont.

In Warsaw, areas important for the preservation of biological diversity are fragments of natural or semi-natural zones (forests, the Vistula valley, oxbow lakes, meadows and swamp). These are areas with a high diversity of flora and fauna, such as, e.g.: Ławice Kiełpińskie Reserve, Bagno Jacka Reserve, Sobieski Forest, Zakole Wawerskie, Natolin Forest, Powsinek, Powsinkowskie Lake, Łęgi Nadwiślańskie, Bielański Forest, Kabacki Forest, Bemowo Forest, Nowa Warszawa Forest, Młociny Forest, as well as forests of Białołęka, Rembertów and Wesoła districts. All these forest areas are key elements of the natural network and are local refuges of biodiversity.

Forest constitute approximately 15% of the total city area<sup>35</sup> (private forests account for 44% of the total forest area in city); the areas with the leading natural function constitute 67% of the city's area<sup>36</sup>. In Warsaw, there are about 6,000 – 7,000 positions of valuable or protected vascular plants, fungi and lichens. About 1.500 spontaneously growing species of vascular plants have emerged in the last 20 years<sup>37</sup>.

Warsaw still retains first generation forest areas created as a result of post-war afforestation of former farmlands and wastelands. The biodiversity of these areas will increase over time, provided that their forest function is preserved. Because of the area covered, forests are an important part of the blue-green infrastructure.

Maintaining their durability and increasing the area of forest resources is important for the preservation and enrichment of Warsaw's biological diversity. There are approximately 6,000-7,000 species of fauna within the city boundary, including approximately 220 that are protected by law<sup>38</sup>. Population trends differ between species with certain species increasing in abundance, others decreasing or appear to be fluctuating. It is important to remember to distribute

new green spaces equally throughout the city, and to take particular care to extend existing accessibility to these spaces for all groups in society. It should be emphasized that the biodiversity of Warsaw results primarily from the following historical transformations and their scope in various parts of the city. Whereas the number of species present in a given area does not directly prove their value in terms of biodiversity.

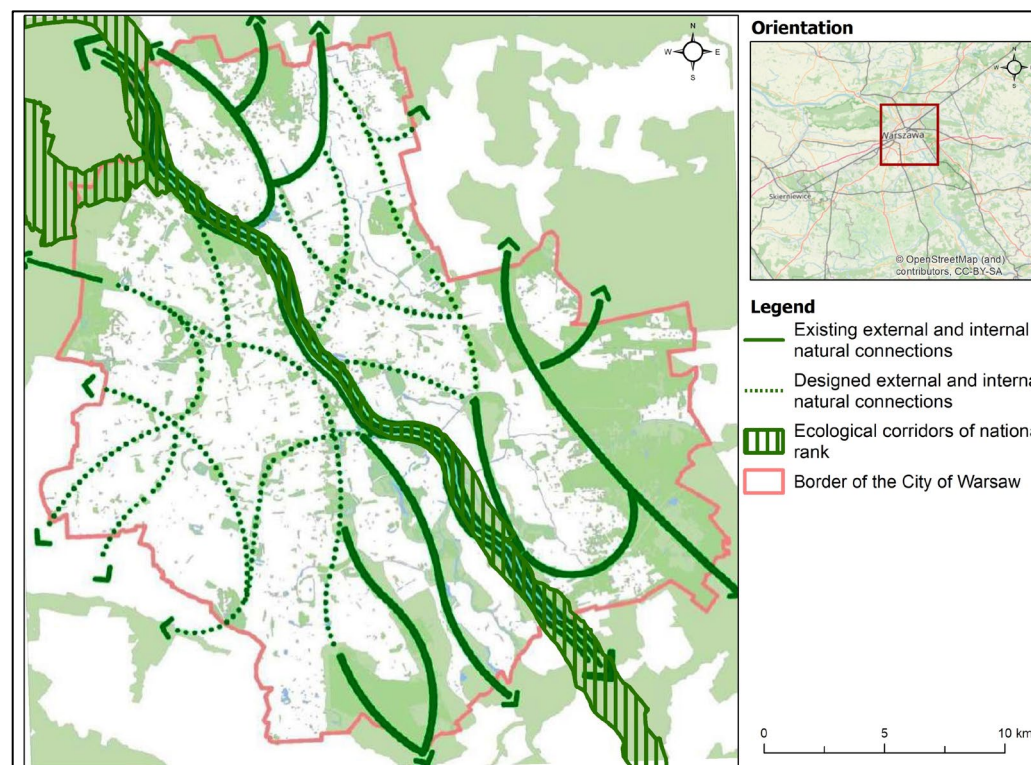


Figure 9. Warsaw's existing and planned nature corridors. (Source: Environmental Protection Program for the Capital City of Warsaw for the years 2021-2024; The Board of Greenery of the capital City of Warsaw)

### 3. Assessment of the existing state of the city

#### 3.3 Greenhouse gas inventory

##### Introduction to GHG emissions reporting

Since 2018, a greenhouse gas emissions inventory has been carried out in the City of Warsaw in accordance with the guidelines and using the C40 tools (the so-called CIRIS). This inventory is also aligned with international best practice standard – the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (known as the GPC). Reporting for Warsaw covers the BASIC level, i.e. CO<sub>2</sub> emissions from the residential sector and energy infrastructure, transport and waste. The inventory helps track emissions, but also provide insights into factors driving emissions in the city such as transportation, waste and energy use in buildings.

##### Inventory

The baseline city-wide GHG inventory covers emissions associated with buildings, facilities (known as stationary energy), transportation, and waste. Warsaw’s latest GHG inventory describes emissions in 2018 and is used as a base year for the GCCAP and the modelling described in section 5.

Note: The GHG inventory was prepared for 2007, it was the base year of the inventory carried out in 2-year cycles. under the Covenant of Mayors (SEAP).

However, it was not aligned with the GPC standard. The 2007 estimate found emissions across the city to be 13 tCO<sub>2</sub>e. Due to differences in methods used, this cannot be directly compared with the 2018 data presented here.

Warsaw, as a member of the Global Covenant of Mayors for Climate & Energy (GCoM), has a climate target – achieving a 40% emission reductions by 2030 against 2007 levels,

which, in absolute numbers, means a reduction in the city's annual emissions to 7.8 Mg CO<sub>2</sub>e.

Acknowledging the potential methodological differences, this equates to approximately 35% reduction from 2018 levels, which in absolute numbers also means a reduction in the city's annual emissions to 7.8 million tCO<sub>2</sub>e. For clarity, when discussed in the GCCAP, emissions targets have been expressed as a percentage reduction compared to either base year.



Figure 10. Warsaw GHG inventory split, as per the GHG protocol for cities (GPC), in 2018

## 3. Assessment of the existing state of the city

### 3.3 Greenhouse gas inventory

#### Inventory results – 2018

The inventory was made by sectors as well as by three ranges, selected depending on the purpose of calculating the carbon footprint. Pursuant to the Directive of the European Parliament and of the Council of 26 June 2013 on the annual financial statements, consolidated financial statements and related reports of certain types of entities, emissions are divided into three ranges:

- **Scope 1**  
**Direct emissions** resulting from sources located within the city boundary. Emissions i.e. from public transport, energy consumption of municipal buildings, energy consumption in water and wastewater treatment processes.
- **Scope 2**  
**Indirect emissions** resulting from the consumption of imported (purchased or supplied from outside) electricity, heat.
- **Scope 3**  
**Other indirect emissions** from the entire value chain, e.g. waste management.

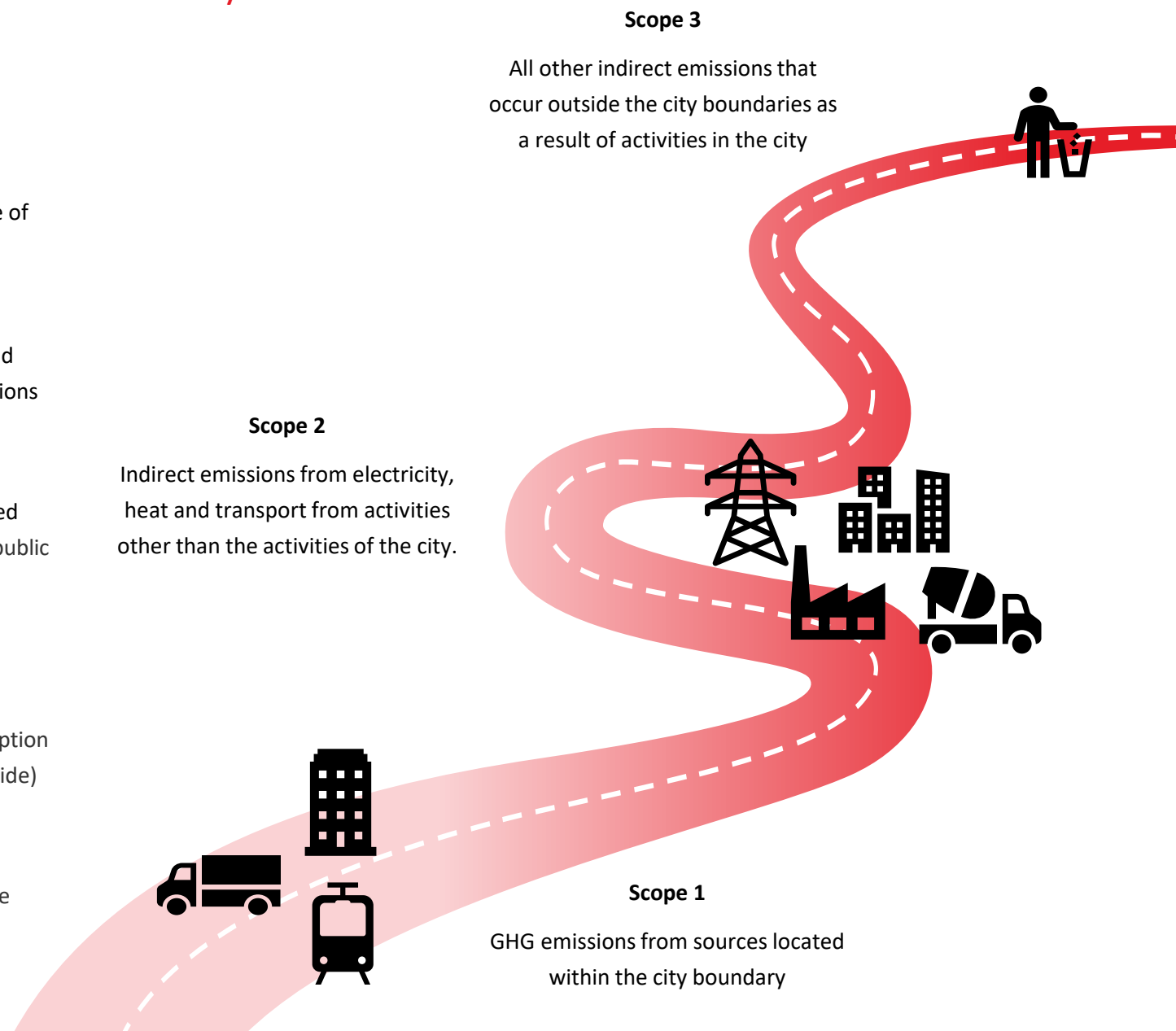


Figure 11. Greenhouse gas inventory ranges

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## 3. Assessment of the existing state of the city

### 3.3 Greenhouse gas inventory

#### Inventory results – 2018

##### Buildings

As shown in the emissions breakdown in Figure 10, residential and commercial buildings contributed over 9.9m tCO<sub>2</sub>e of a total 12m. This is primarily a result of the electricity consumed in these buildings, as well as heat that is supplied through the district heating network. These are known as Scope 1 and Scope 2 emissions sources, as the emissions are physically taking place at the power plants, but under the GPC standard they are allocated to the buildings where the energy is used. Emissions from Scope 2 are high in Warsaw due to the electricity partial reliance on coal and district heating reliance on coal CHP's (combined heat and power plants).

There is also some direct use of fuels (mostly from natural gas) in these buildings (known as Scope 1), primarily for heating and cooking purposes.

In total, residential and commercial buildings represent two thirds of total citywide emissions.

Industrial buildings represent a 1.6m tCO<sub>2</sub>e, which is mostly warehouses and data centres that consume a significant amount of electricity.<sup>39</sup>



Photo: Mohammed Ajwad, Pexels

## 3. Assessment of the existing state of the city

### 3.3 Greenhouse gas inventory

#### Inventory results – 2018



Photo: Bianca Fazacas, Pexels

#### Transportation

The transportation sector is responsible for 15% of total emissions, the vast majority of which (85%) comes from on-road transportation. Within this, the majority of vehicle kms (over 80%) is from passenger cars, with over half (54%) of these being gasoline, around a third diesel (35%), and the majority of the remainder being LPG cars (9%). The remaining transportation emissions in the 2018 inventory comes from rail, electric trams, metro and trains contributing almost 300k tCO<sub>2</sub>e. Similar to buildings, emissions from rail are linked to the high emissions intensity of the electricity grid. Furthermore, the City is aware that emissions from ‘landing and take-off’ at Chopin Airport comprises an additional 1.3m tCO<sub>2</sub>e counted under Scope 3 (emissions that occur outside the city boundary as a result of activity within the city). **These Scope 3 emissions are excluded from the GHG modelling of the city as they represent sources less directly under policy control of the city<sup>40</sup>.**



Photo: City of Warsaw

## 3. Assessment of the existing state of the city

### 3.3 Greenhouse gas inventory

#### Inventory results – 2018

##### Waste

Waste management related emissions account for a small part of the GHG emissions in the inventory (under 1% of the total)<sup>41</sup>, which was acknowledged as a data gap by the city GCCAP team and targeted for future improvement.

Most of the waste generated in Warsaw is transported outside of the city for management, including waste-to-energy generation. Therefore, they are counted at the recipient of the waste as emissions from energy production. This means that the municipality or area importing this waste to incinerate in order to create energy would accrue the emissions associated with treatment of this waste, rather than their production.

Nevertheless, waste and waste system actions are still considered within the GCCAP, but the estimation of emissions as a result of waste management shall be improved in future GHG inventories.



Photo: mpo.com.pl




### 3. Assessment of the existing state of the city

#### 3.3 Greenhouse gas inventory

##### Inventory results – 2018

The following table presents the results of the CO<sub>2</sub> emissions inventory in selected sectors.

Table 7. Sectoral GHG emissions in 2018

Sector		Scope 1 tCO <sub>2</sub> e	Scope 2 tCO <sub>2</sub> e	Scope 3 tCO <sub>2</sub> e
	Buildings	1 629 109	8 261 612	
	Transportation	1 790 518	301 014	1 338 807
	Waste	32 131		
<i>Total</i>				<i>13 353 191</i>
<b>Total, after excluding the emissions from Scope 3</b>				<b>12 014 384</b>

# 4. Green City vision, scenarios and objectives





## 4. Green City vision, scenarios and objectives

Our green vision for Warsaw has focused on developing strategies, objectives and actions for key sectors to improve the quality of life of our citizens, achieve carbon neutrality by 2050 and enable us transition to a resilient, biodiverse and sustainable city.



Photo: City of Warsaw

## 4. Green City vision, scenarios and objectives

### 4.1 Green City and Climate Action Plan of Warsaw, scenarios and objectives

Warsaw's goal is to achieve climate neutrality by 2050, therefore:

- As an intermediate objective (by 2030), the City of Warsaw has set the achievement of an emission reduction level of ~35% compared to 2018 (corresponding to an emission reduction of ~40% compared to 2007),
- As a potential intermediate objective, the City of Warsaw has adopted the aim of achieving even more ambitious targets by reducing emissions by 54% compared to 2018. (equivalent to a ~60% reduction compared to 2007) - in the Extended Scenario.

Warsaw's binding target is, at the moment, 40% GHG reductions by 2030 (compared to 2007) and net-zero by 2050. However, the city's ambition is higher than that and Warsaw has set an additional aspirational target of around 60% reductions by 2030.

Acknowledging that there are several barriers to overcome for this intermediate target to be achieved, Warsaw will report to both targets to prove that, should the external conditions be achieved, the city will be ready to honour this more ambitious target.

To build a foundation that will help link emission reduction targets to the implementation of the GCCAP and the characteristics of Warsaw's emissions, the city created an emissions model and strategy scenarios using the C40 "Pathways" tool.

The results of the emission modelling are discussed in Chapter 3.3 Greenhouse gas inventory.

The modeling and analysis allowed to prepare three scenarios for climate action over a 30-year perspective that model potential reductions in CO2 emissions up to 2050. They also taking into account changes independent of the city and municipal companies, which are presented on the next page. The first scenario analysed is the **Business as usual**, which takes into account the "no additional climate action", emissions projection and also has in mind the estimated growth of the city's GDP.

The second accepted scenario is the **GCCAP Reduction Scenario**, long-term objectives were defined to allow the implementation of the Climate Action Plan (CAP). The implementation of long-term objectives will facilitate the implementation of the developed short-term objectives (covering the perspective of 10-15 years) for the development of the Green City Action Plan (GCAP).

The third scenario analysed is the **Extended Scenario**. This scenario is potentially feasible in the city if two premises are met: the city will operate in favourable political conditions (Poland's climate policy will be developed, enabling the City of Warsaw to meet its ambitious climate objectives) and the city will receive sufficient financial resources (domestic and European) for the

implementation of pro-climate measures. The assumptions of this Extended Scenario are included in Appendix C of this document. The GCCAP outlines 27 short-term actions that will initiate work to achieve the ambitious objectives and accelerate the city's achievement of climate neutrality.

Thanks to the prepared scenarios, the city has the basis for further development of directions for activities and necessary processes for implementation to ensure the sustainable development of the city and the sustainable implementation of objectives for the next 30 years.

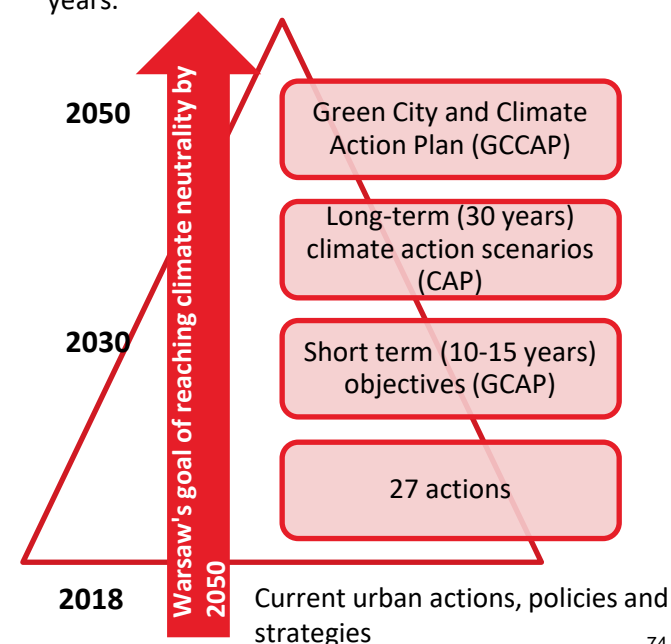


Figure 12. Process for reaching climate neutrality by 2050.

## 4. Green City vision, scenarios and objectives

### 4.2 Long-term scenarios for climate action over a 30-year perspective

Table 8. Long-term scenarios of the Climate Action Plan

2018	2030	2050
<p><b>Business-as-usual Scenario (BAU)*</b></p> <p>A „no-climate-action” forecast of emissions, which takes account of forecasted city growth in GDP, used as a reference from which to benchmark strategies that reduce emissions.</p>	<p><b>40% increase</b> in emissions compared to 2018.</p>	<p><b>100% increase</b> compared to 2018.</p>

\* The modelling uses the same population in the base year (2018) of 1,777,972, as the GHG inventory in CIRIS, to maintain consistency in the emissions evidence base. In the Pathways model, this population value is multiplied out to 2025, 2035 and 2050 using a population growth rate from Oxford Economics. To generate the „business-as-usual” scenario, the population growth rate is used in conjunction with GDP growth to devise composite growth rates for each subsector of emissions that reflects that activity (e.g. residential buildings being driven more by population growth, and commercial buildings more by GDP). The modelling and strategy identification analysis was conducted throughout 2021 to the best available data at the time. Since then, subsequent data or plans may emerge with updated population or GDP values, this information will be considered by the city in future analysis and iterations of city climate action plans.

## 4. Green City vision, scenarios and objectives

### 4.2 Long-term scenarios for climate action over a 30-year perspective

Table 8. Long-term scenarios of the Climate Action Plan

2018	2030	2050
<p><b>GCCAP Reduction Scenario*</b></p> <p>Includes strategies that are ambitious yet achievable. Expanding on existing policies to define the most ambitious actions the city could implement.</p>	<ul style="list-style-type: none"> <li>• district heating system switch from coal to gas;</li> <li>• distributed renewables fitted to all municipal buildings;</li> <li>• All new buildings nearly net zero, some retrofits of existing buildings (from 2030, the EU is to prohibit the use of gas-fueled heat sources in modernized buildings), replaced majority of existing gas-fueled heat sources with heat pumps by 2035;</li> <li>• improving the energy efficiency of service and office buildings;</li> <li>• Modal shift coupled with cleaner fleets &amp; fuels.</li> </ul>	<ul style="list-style-type: none"> <li>• carbon neutral district heat and 0 coal in national electricity grid;</li> <li>• distributed renewables fitted to most private buildings;</li> <li>• 40% of all buildings retrofitted citywide;</li> <li>• Two thirds of passenger cars and all buses, EV or hydrogen.</li> </ul> <p><b>Reduction ~35% compared to 2018.</b></p> <p><b>Net Zero</b></p>

\* The modelling uses the same population in the base year (2018) of 1,777,972, as the GHG inventory in CIRIS, to maintain consistency in the emissions evidence base. In the Pathways model, this population value is multiplied out to 2025, 2035 and 2050 using a population growth rate from Oxford Economics. To generate the „business-as-usual” scenario, the population growth rate is used in conjunction with GDP growth to devise composite growth rates for each subsector of emissions that reflects that activity (e.g. residential buildings being driven more by population growth, and commercial buildings more by GDP). The modelling and strategy identification analysis was conducted throughout 2021 to the best available data at the time. Since then, subsequent data or plans may emerge with updated population or GDP values, this information will be considered by the city in future analysis and iterations of city climate action plans.

## 4. Green City vision, scenarios and objectives

### 4.2 Long-term scenarios for climate action over a 30-year perspective

Table 8. Long-term scenarios of the Climate Action Plan

2018	2030	2050
<p><b>Extended Scenario*</b></p> <p>Identifies the strategies that would be required to close the gap between the 'GCCAP' scenario and required level to meet a fair-share 1.5 degrees warming scenario for Warsaw (as defined by C40 'Deadline 2020').</p>	<ul style="list-style-type: none"> <li>• faster installation of more efficient solar PV in private buildings;</li> <li>• obtaining fully green energy in the city by 2035;</li> <li>• expanded buildings retrofit.</li> </ul>	<p><b>Reduction:</b></p> <p>~50% compared to 2018</p> <p><b>Net Zero</b></p>

\* The modelling uses the same population in the base year (2018) of 1,777,972, as the GHG inventory in CIRIS, to maintain consistency in the emissions evidence base. In the Pathways model, this population value is multiplied out to 2025, 2035 and 2050 using a population growth rate from Oxford Economics. To generate the „business-as-usual” scenario, the population growth rate is used in conjunction with GDP growth to devise composite growth rates for each subsector of emissions that reflects that activity (e.g. residential buildings being driven more by population growth, and commercial buildings more by GDP). The modelling and strategy identification analysis was conducted throughout 2021 to the best available data at the time. Since then, subsequent data or plans may emerge with updated population or GDP values, this information will be considered by the city in future analysis and iterations of city climate action plans.

## 4. Green City vision, scenarios and objectives

### 4.2.1 GCCAP Reduction Scenario

In order to develop a set of actions for short-term implementation, modelling of the **GCCAP Reduction Scenario** was carried out. Achieving these objectives would allow the city to achieve its long-term objectives. This contains the most feasibly ambitious strategies and technology shifts, that could be achieved, which were defined following a stakeholder-led process of workshops and focused meetings with city sectoral departments.

This scenario is in line with the city's intermediate CO<sub>2</sub> reduction objective. It assumes a 35% reduction in CO<sub>2</sub> emissions by 2030 (relative to 2018), and in the long term by 2050 - climate neutrality. The achievement of the final objective will be achieved mainly due to continuing decarbonisation of electricity and heat that serves the city.

The model shows that the greatest impact on reducing the city's CO<sub>2</sub> emissions by 2050 will come from:

- electricity decarbonisation, from the national grid and distributed renewables (solar PV) which will deliver a 33% reduction in the city's total CO<sub>2</sub> emissions;
- increasing the energy efficiency of buildings and fuel switching (31% reduction in CO<sub>2</sub> emissions);

- decarbonisation of the district heating network (12% reduction in CO<sub>2</sub> emissions);
- improving the energy efficiency of service and office buildings (16% reduction in CO<sub>2</sub> emissions);
- transportation fuel and mode switch (9% reduction in CO<sub>2</sub> emissions).

\* The goals set for the thermomodernisation of buildings are in line with the Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 and the Long-term Strategy for the Renovation of Buildings of the Ministry of Development and Technology.

Warsaw acknowledges that the strategies in this GCCAP scenario require a huge amount of effort from the city government, significant political and financial action from other stakeholders and city community. Warsaw is committed to demonstrating, what would be required to achieve its targets and accelerate the implementation of the CO<sub>2</sub> emission reduction scenario in the city, taking all actions within its power to accelerate and advocate for the steps outside of its direct control, meanwhile influencing and engaging other entities in action to achieve climate neutrality.

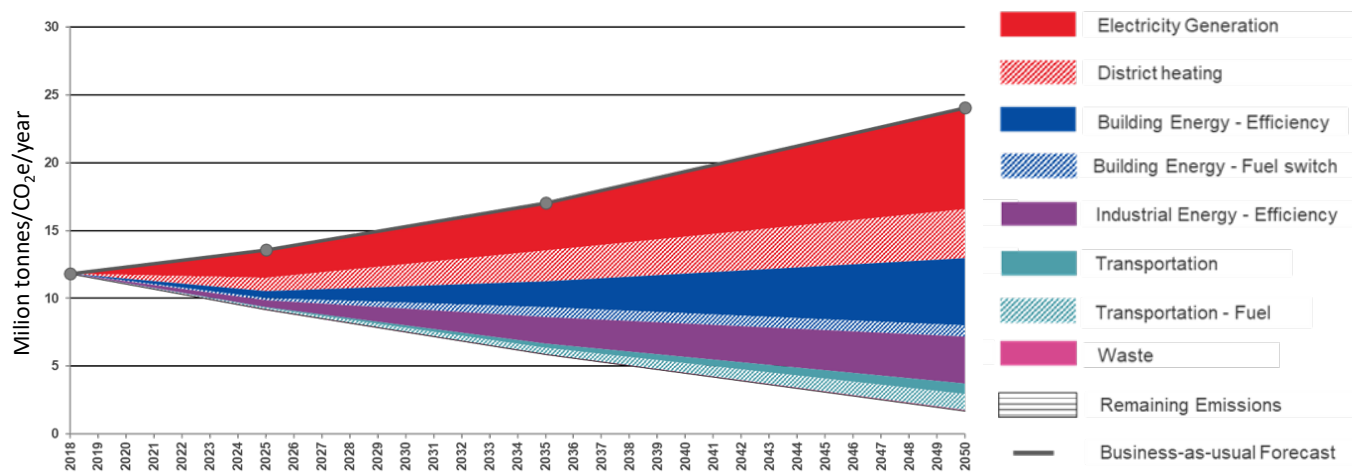


Figure 13. Warsaw's citywide GHG tonnes of emissions per year over the four horizon years in the model and how they grow (2018-2025-2035-2050) - potential of selected actions under GCCAP Reduction Scenario

## 4. Green City vision, scenarios and objectives


### 4.2.1 GCCAP Reduction Scenario

Table 9. GCAP actions alignment with the CAP strategies in the energy sector

#### Energy sector

CAP long-term objectives

GCAP short-term objectives


CAP theme			GCAP actions to achieve long-term objectives
district heat decarbonisation	<p><b>Gas use intensification</b></p> <p>switch all power plants serving the network away from coal to use mostly gas and potential use of hydrogen (and some biomass &amp; RDF, waste heat and large scale heat pumps).</p>	<p><b>Renewable energy sources and waste heat</b></p> <p>switch from gas-oriented system to renewables and waste heat</p>	<p>ID <u>E2</u>, <u>E6</u>, <u>Ok1</u></p>

## 4. Green City vision, scenarios and objectives

### 4.2.1 GCCAP Reduction Scenario

Table 9. GCAP actions alignment with the CAP strategies in the energy sector

#### Energy sector

CAP theme	CAP long-term objectives		GCAP short-term objectives
	2035	2050	
grid decarbonisation			GCAP actions to achieve long-term objectives
	<p><b>0% share of coal in the energy mix of the grid</b></p> <p>national electricity grid: achieving 0 coal in the energy mix, replaced by an increase in renewables</p>		ID <u>E1</u> , <u>E2</u> , <u>E3</u> , <u>E6</u>
	<p><b>100% electricity from renewable energy sources</b></p> <p>from 2025, all energy purchased by the City should have guarantees of origin. By 2030, the city and municipal companies should balance their consumption with electricity production from RES or energy purchases directly to RES producers.</p>		ID <u>E1</u> , <u>E2</u> , <u>E3</u> , <u>E4</u> , <u>E5</u>
<p><b>60% of the district heating demand for electricity</b></p> <p>maintain 60% of electricity demand met by district heating, meanwhile decarbonising the network.</p>		ID <u>E2</u> , <u>E6</u> , <u>B1</u> , <u>B3</u>	



## 4. Green City vision, scenarios and objectives


### 4.2.1 GCCAP Reduction Scenario

Table 9. GCAP actions alignment with the CAP strategies in the energy sector

#### Energy sector

CAP long-term objectives

GCAP short-term objectives

CAP theme			GCAP actions to achieve long-term objectives
distributed renewables (PV)	<p><b>20% of residential buildings and in other urbanized areas, where it is technically possible and reasonable (e.g., parking lots) and 30% of commercial buildings and in other urbanized areas, where it is technically possible and reasonable (e.g., parking lots) with PV systems*</b></p> <p>*Install solar PV systems on residential and commercial buildings, having achieved 100% of city-owned buildings by 2030.</p>	<p><b>60% of residential buildings and in other urbanized areas, where it is technically possible and reasonable (e.g., parking lots) and 80% of commercial buildings and in other urbanized areas, where it is technically possible and reasonable (e.g., parking lots) with PV systems*</b></p> <p>*Install solar PV systems on most residential and commercial of city-owned buildings.</p>	ID <u>E1</u> , <u>E2</u> , <u>E3</u> , <u>B1</u> , <u>B2</u> , <u>B3</u> , <u>T3</u>

## 4. Green City vision, scenarios and objectives

### 4.2.1 GCCAP Reduction Scenario

Table 10. GCAP actions alignment with the CAP strategies in the buildings sector

Buildings sector			
CAP theme	CAP long-term objectives		GCAP short-term objectives
	2035	2050	GCAP actions to achieve long-term objectives
all new buildings - Warsaw Green Building Standards	Nearly net zero new builds from 2025.		ID <u>E3</u> , <u>B1</u> , <u>B2</u>
existing buildings - retrofits	<b>Comprehensive thermomodernisation of 36% of residential and commercial buildings</b> The model assumes that by retrofitting residential and commercial buildings with whole-building insulation once (windows, roof, wall insulation, replacement of internal heating systems in buildings with low-temperature insulation), they will be treated as energy-efficient until 2050.	<b>Comprehensive thermomodernisation of 81% of residential and commercial buildings</b>	ID <u>B2</u> , <u>B3</u>
heating and water heating - fuel switch	<b>Install heat pumps</b> The replacement of solid fuels, oil, and gas heat sources with heat pumps or connection to an efficient district heating system by 2035.		ID <u>E3</u> , <u>B1</u> , <u>B2</u> , <u>B3</u>
industrial buildings efficiency improvement	<b>Increase the efficiency of industrial buildings by 60%</b> Work with the private sector to increase efficiency of these buildings by 2035.		ID <u>B1</u> , <u>B2</u> , <u>B3</u>

## 4. Green City vision, scenarios and objectives

### 4.2.1 GCCAP Reduction Scenario

Table 11. GCAP actions alignment with the CAP strategies in the transport sector

Transport sector			
CAP theme	CAP long-term objectives		GCAP short-term objectives
	2035	2050	GCAP actions to achieve long-term objectives
mode shift		<b>100% more trips by cycling</b> currently from 7.5% - increase to 15%	ID <u>R1</u> , <u>R4</u> , <u>T1</u> , <u>T3</u> , <u>IT1</u>
		<b>35% less trips taken by private vehicles</b> reduction of the share of trips by passenger vehicles (cars)	ID <u>R1</u> , <u>R4</u> , <u>T1</u> , <u>T2</u> , <u>T3</u> , <u>T4</u> , <u>T5</u> , <u>IT1</u>
		<b>53% of trips by public transport</b> increase the proportion of total citywide trips by public transport from 47% (currently)	ID <u>R1</u> , <u>R4</u> , <u>T1</u> , <u>T2</u> , <u>T3</u> , <u>T5</u> , <u>IT1</u>
passenger vehicle - fuel switch	<b>24% of passenger cars moving around the city to be hydrogen or EV</b>	<b>64% of passenger cars to be hydrogen or EV</b>	ID <u>E2</u> , <u>E4</u> , <u>T4</u> , <u>IT2</u>

## 4. Green City vision, scenarios and objectives

### 4.2.1 GCCAP Reduction Scenario

Table 11. GCAP actions alignment with the CAP strategies in the transport sector

Transport sector			
CAP theme	CAP long-term objectives		GCAP short-term objectives
	2035	2050	GCAP actions to achieve long-term objectives
transit vehicle – fuel switch		<p><b>100% of city buses to be electric or hydrogen</b></p> <p>all city buses* to be electric or hydrogen powered</p> <p>*all companies providing transport services in the city</p>	ID T2

## 4. Green City vision, scenarios and objectives

### 4.3 Short-term (10-15 years) objectives

In consultation with Stakeholders, as a result of workshops and analysis, a series of tangible short term (10-15 years) Green City objectives have been developed for each sector, that set the overarching framework for the actions within the GCCAP and together enable us to achieve our Green City vision.

The short-term objectives have been developed to directly respond to the key environmental challenges there were identified in the city baseline. They are also in alignment with the existing national targets and programs and have been selected to complement Warsaw's ongoing efforts to tackle environmental issues and achieve climate neutrality.

The objectives for each sector are identified in the narratives presented in the graphic to the right.

Details on the monitoring and reporting of progress in the implementation of the assumed activities were discussed with the Stakeholders for each sector are presented in section 6.

#### Energy Infrastructure

The city will build up its renewable energy capabilities and look to power heat and electricity through zero- and low-emission sources. This in turn will lower GHG emissions and improve local air quality.

#### Buildings

The building sector is the main source of greenhouse gas emissions into the city's atmosphere. A significant problem is the energy inefficiency of buildings, which increases GHG emissions and deterioration of air quality. In addition, the issue of energy poverty in the city is worsening as fuel prices rise dramatically. Existing buildings will be retrofitted and new developments built to meet updated standards in energy saving, green building and ecological solutions. Buildings heated with solid and oil fuels are a source of air pollution on a local scale.

#### Water, green space and biodiversity

Warsaw will create a climate resilient city through maintaining existing and developing blue-green infrastructure and set guidelines for new developments. The city will have urban sustainable rainwater management system, more green spaces and increase in biodiversity in its area. Warsaw will encourage and promote the development of private land in line with urban good practice.

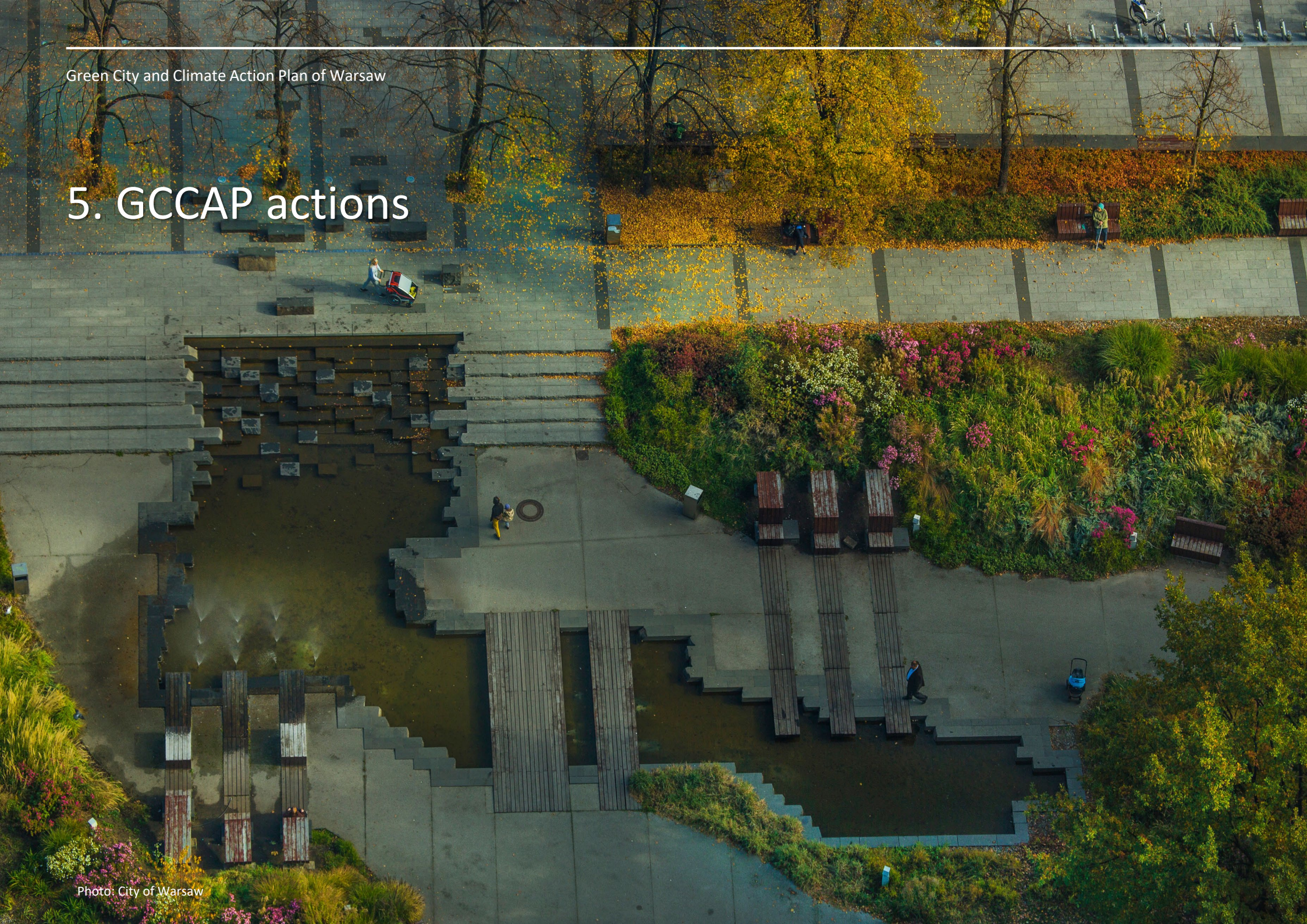
#### Transport

Warsaw's transport sector will be transformed to become more accessible to all, more efficient (providing opportunities for more effective communication), integrated (combining different modes of transport) and sustainable (energy-efficient and low-emission). There will be increased investment in rail (underground, tram, rail), pedestrian and cycling infrastructure with a focus on zero-emission transport.

#### Solid Waste

Warsaw will embed circular economy principles within its waste collection and recycling. The development of an efficient, cost-effective waste treatment infrastructure within the city will be prioritised.

# 5. GCCAP actions



## 5. GCCAP actions

### 5.1 Introduction

This section sets out the GCCAP actions proposed to bring about a positive transformation of our transport sector, buildings, energy infrastructure, urban planning processes, blue-green infrastructure and solid waste systems. Together, these actions are designed to protect our city's nature, adaptation to climate change, improve our air quality, reduce carbon emissions and improving the quality of life for residents.

The actions are not a circular catalogue but only the first of many actions that will have to happen in the city in order to achieve the climate goals. In the first instance, they form a catalogue of possible and inspiring actions to be taken in the later years, up to 2030 and 2050.

For each key sector included within the Plan, we provide an overview of the key challenges it faces, and the short-term objectives that have shaped the development of the actions. Details on the implementation of actions including:

- proposed financing routes,
- important barriers to overcome,
- the roles and responsibilities of the City and key actors are also provided.

A detailed description of each action is provided in the action Tables in Appendix A Green City Action Description.



Photo: Victor Malyushev, Unsplash

## 5. GCCAP actions

### 5.2 List of actions

#### Energy Infrastructure

E1 Purchase of green energy for municipal units

E2 Generation of green Energy by the city within and outside Warsaw's borders

E3 Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral

E4 Development of a Municipal Hydrogen Program

E5 Creation of the Municipal Energy Agency

E6 Energy strategic partnership

E7 Creation of a Sustainable Energy Investments Fund

E8 Outdoor city lighting – LED retrofit

#### Buildings

B1 Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction

B2 Program to improve the energy efficiency of municipal buildings with a pilot

B3 Continued replacement of high-emission heat sources

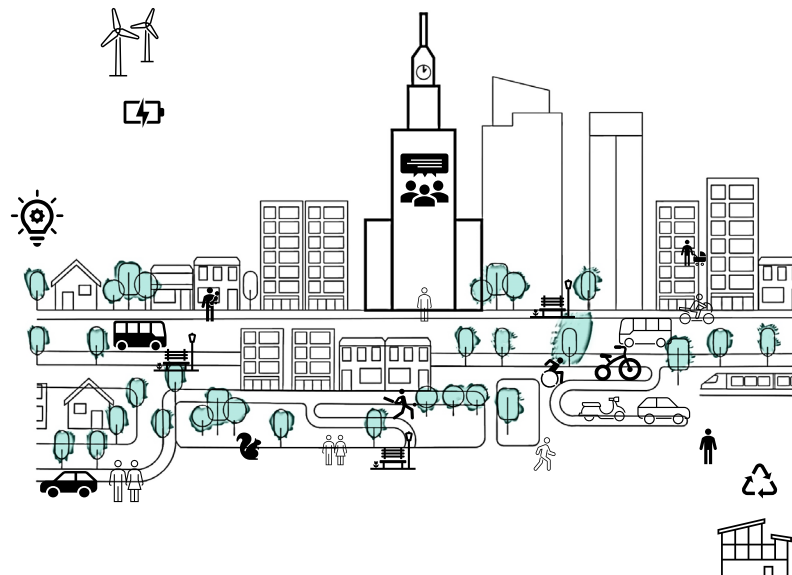
#### Urban planning and blue-green infrastructure

R1 Increasing biologically active surfaces and removing impermeable surfaces

R2 Protection and restoration of valuable green areas

R3 Preservation & restoration of urban greenery Zakole Wawerskie

R4 Greening streets





## 5. GCCAP actions

### 5.2 List of actions

#### Transport

T1 Continued expansion of municipal integrated rail transport

T2 Convenient and safe zero-emission public transport

T3 Development of transport interchange and communication hubs

T4 Support for the development of electromobility

T5 Research on public transport needs

T6 Program supporting the implementation of Clean Transport Zones

IT1 Integrated ticketing for the agglomeration as a part of public transport management

IT2 Smart local energy systems including vehicle-to-grid and vehicle-to-building

#### Solid Waste

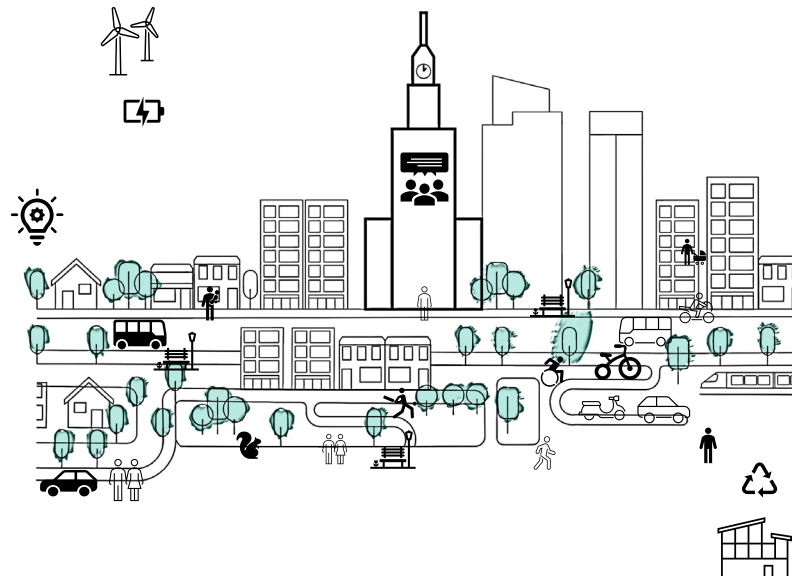
Ok1 Municipal biogas plants development program

Ok2 HWRC - Household waste recycling centres

#### Equity and inclusion

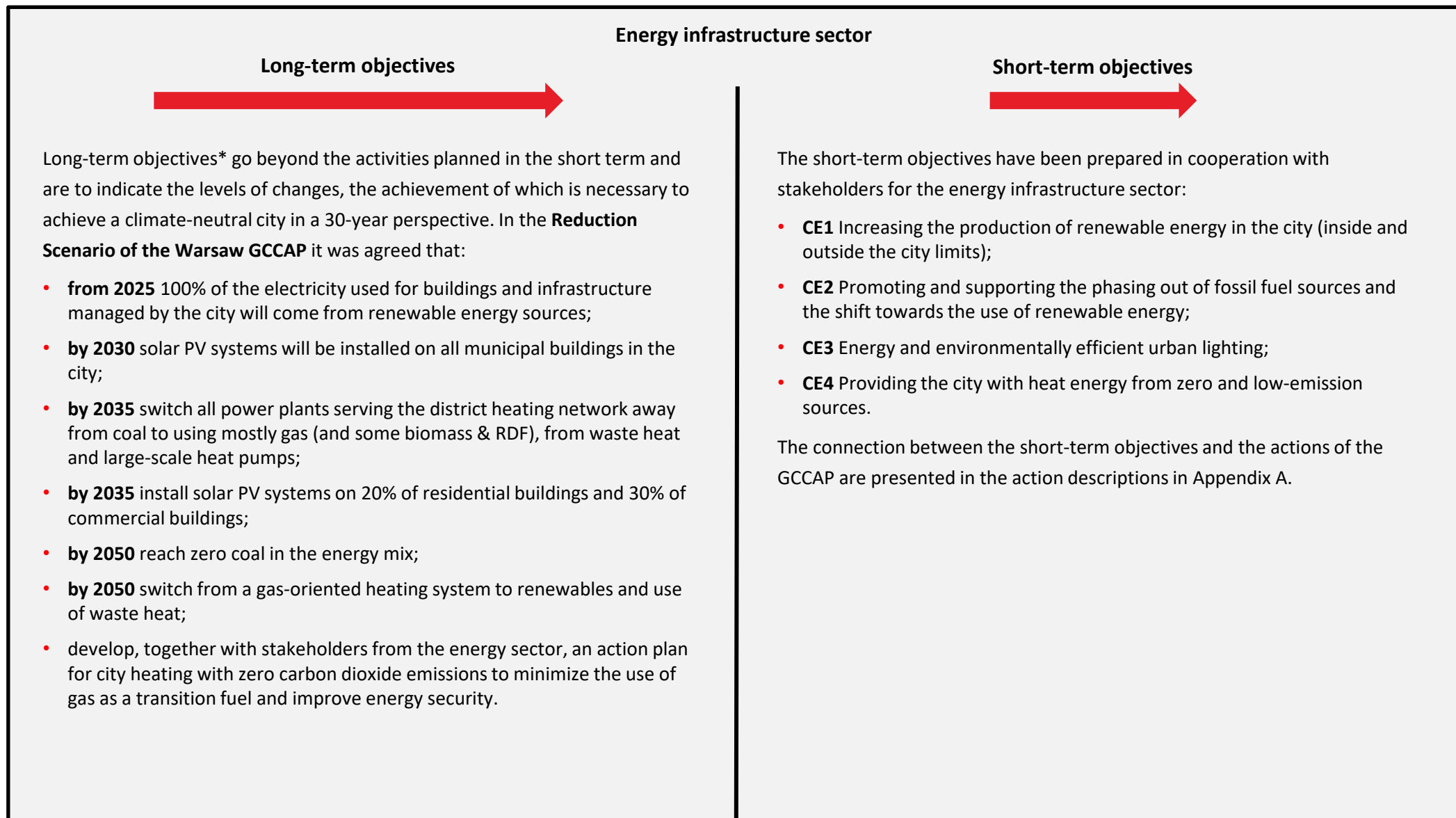
PS1 Education campaigns

PS2 Tackling energy poverty



## 5. GCCAP actions

### 5.3 Energy infrastructure long-term and short-term objectives



\* Long term objectives have been set in relation to the base year (2018).

## 5. GCCAP actions

### 5.4 Energy infrastructure actions

The decarbonisation of electricity plays a critical role in the transition of Warsaw to climate neutrality. Warsaw's energy transformation in line with the **Green Vision** means increasing the energy efficiency of infrastructure and buildings in the City, which will ultimately be powered primarily by electricity produced from renewable sources. In terms of heating, it means a mix of heating with heat pumps and an efficient district heating system producing heat from renewable sources or using waste heat.

Transforming the energy system can significantly improve the city's air quality and hence improving the physical health of residents in Warsaw. However, Warsaw can play an important role in taking measures to increase the production of energy from renewable sources or the supply of green energy. In addition, it can use lobbying and negotiation opportunities to forge partnerships that will enable and accelerate wider investments in decarbonizing the energy sector.

#### Key challenges

1. The **carbon intensity of the energy system is high**, and electricity is supplied mainly from the National Power System, which affects the city's control over this is limited.
2. Coal **makes up 85%** of the grid electricity supply mix.

3. Heating carbon intensity is also high, owing to the largely **coal-fired district heating network**.
4. The **city's control is limited** to direct investment (e.g., in renewable energy) and energy supply purchasing decisions for the needs of municipal buildings and urban infrastructure (e.g. street lighting).
5. Electricity grid reliability has improved significantly in recent years, however there are still fairly frequent **supply failures**.
6. **The city has limited influence on the sources from which heat is produced for the district heating network.**

#### Activities carried out

The City of Warsaw has limited powers over energy generation, distribution and transmission within the city, which are regulated at the national level. Projects relating to the development of transmission and distribution grid around Warsaw are underway to improve the security of supply of the city. The state owned operators are also investing in gas CHP plants. Although, these sources, they produce energy that is cleaner than that generated from coal, do not comply with the assumptions of Warsaw's climate neutrality.

#### Green City actions

Warsaw's energy transformation in accordance with the GCCAP means increasing the energy efficiency of infrastructure and buildings in the City, which will ultimately be powered primarily by electricity produced from renewable sources. In terms of heating, it means a mix of heating with heat pumps and an efficient district heating system producing heat from renewable sources or using waste heat. Further decarbonisation of the energy system will be achieved through purchasing of municipal green energy, the development of a hydrogen strategy, the foundation of a new Municipal Energy Agency, the formation of strategic partnerships and the creation of a Sustainable Energy Investments Fund. In implementing the actions set out, must be taken into account the political and economic risks of using gas as a transitional fuel in the energy transition. Electricity and heat sources that are fully climate neutral, such as heat pumps, should also be used.

For more detail on each action, see Appendix A Green City Action Description.

## 5. GCCAP actions

### 5.4 Energy infrastructure actions

**Table 12. GCCAP Energy infrastructure actions summary**

ID	Action	Description	Type	Financial assessment			Estimated carbon emissions reduction*
				Pre-investment (EUR)	CAPEX (EUR)	OPEX (EUR/yr)	
E1	<u>Purchase of green energy for municipal units</u>	All municipal units* should purchase guarantees of green energy origin through a joint energy purchasing office. The municipal units should be encouraged to buy green energy with a guaranteed origin.  *operating in the transport, water and sewage sector and infrastructure: lighting, municipal buildings, back-up services	Operational			34.525m	343.900 tCO <sub>2</sub> /yr
E2	<u>Generation of green Energy by the city within and outside Warsaw's borders</u>	Development of investment in renewable energy sources, mainly towards photovoltaics, wind energy, low-temperature geothermal, biogas and renewable hydrogen.	Capital program	591.5k	131.7m	1.842m	Municipal Photovoltaic Development Program : 87.000 tCO <sub>2</sub> /yr Wind farm: 55.900 tCO <sub>2</sub> /yr Photovoltaic farm: 28.200 tCO <sub>2</sub> /yr

\* Estimated carbon reductions were only calculated for actions where this was possible at this stage (e.g. due to not knowing the scale, type and technology of implementation). A detailed assessment will be made at a later stage during e.g. the development of a feasibility study for an action.

## 5. GCCAP actions

### 5.4 Energy infrastructure actions

**Table 12. GCCAP Energy actions summary in the energy infrastructure sector**

ID	Action	Description	Type	Financial assessment			Estimated carbon emissions reduction*
				Pre-investment (EUR)	CAPEX (EUR)	OPEX (EUR/yr)	
E3	<u>Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral</u>	Improving the efficiency of the use of resources of the Municipal Enterprise Water Supply and Sewerage in Warsaw S.A. through further development of renewable energy production from biogas, development of technology for heat recovery from sewage and sludge, implementation of an effective sewage sludge management system and the use of photovoltaic panels on the premises of subsequent plants, in order to reduce energy consumption in water production and wastewater treatment processes.	Capital program		14.7m	6.702m	46.800 tCO <sub>2</sub> /yr
E4	<u>Development of a Municipal Hydrogen Program</u>	Strategy for the development of hydrogen energy sources in the city as a potentially low carbon energy vector for industry and transport.	Enabling	186k			-

\* Estimated carbon reductions were only calculated for actions where this was possible at this stage (e.g. due to not knowing the scale, type and technology of implementation). A detailed assessment will be made at a later stage during e.g. the development of a feasibility study for an action.

## 5. GCCAP actions

### 5.4 Energy infrastructure actions

**Table 12. GCCAP Energy actions summary in the energy infrastructure sector**

ID	Action	Description	Type	Financial assessment			Estimated carbon emissions reduction*
				Pre-investment (EUR)	CAPEX (EUR)	OPEX (EUR/yr)	
E5	<u>Creation of the Municipal Energy Agency</u>	Creation of an organisational city unit responsible for the development of renewable energy sources, implementation of the energy efficiency program for both private and city-owned buildings, working on a performance-based contract to pursue cost-effective energy efficiency measures for citizens and businesses. Implementation of city strategies and plans of achieving climate neutrality in the energy sector, with particular emphasis on the development of local energy ownership (“prosumerism”).	Enabling	76.6k		328.5k	-
E6	<u>Energy strategic partnership</u>	Establish a partnership with the Warsaw energy sector to implement: strategies to improve energy efficiency, renewable energy sources and reduce greenhouse gas emissions.	Enabling	33k		6.6k	-

\* Estimated carbon reductions were only calculated for actions where this was possible at this stage (e.g. due to not knowing the scale, type and technology of implementation). A detailed assessment will be made at a later stage during e.g. the development of a feasibility study for an action.

## 5. GCCAP actions

### 5.4 Energy infrastructure actions

**Table 12. GCCAP Energy actions summary in the energy infrastructure sector**

ID	Action	Description	Type	Financial assessment			Estimated carbon emissions reduction*
				Pre-investment (EUR)	CAPEX (EUR)	OPEX (EUR/yr)	
E7	<u>Creation of a Sustainable Energy Investments Fund</u>	A city-led green fund to draw in investors to support the energy transition programme. As with other energy actions, this action would be facilitated through the creation of a dedicated Municipal Energy Agency.	Enabling	76.6k	17,5m	65.7k	-
E8	<u>Outdoor city lighting – LED retrofit</u>	Replacing street lamps with energy-saving multi-functional LED street lamps.	Capital program		11m	3.3m	35.900 tCO <sub>2</sub> /yr

\* Estimated carbon reductions were only calculated for actions where this was possible at this stage (e.g. due to not knowing the scale, type and technology of implementation). A detailed assessment will be made at a later stage during e.g. the development of a feasibility study for an action.

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## 5. GCCAP actions

### 5.4 Energy infrastructure actions

#### Action implementation

The actions in the energy sector will be implemented through operational and enabling actions as well as capital projects and programs. The synergy between these actions is presented on the next page. As part of the actions of the GCCAP, the city will especially focus on solutions and dedicated actions aimed at counteracting energy poverty. This will be done through a system of fees, subsidies and discounts. These solutions will be inclusive and create equal opportunities for all social groups.

#### Financing route

**Pre-investment costs:** 963,7k EUR (4,4m PLN)

**CAPEX:** 174,9m EUR (799,3m PLN)

**OPEX:** 46,8m EUR (213,338m PLN)

Suitable methods of financing:

- City and State budget,
- EU-financial support programs,
- Private sector, e.g. public-private partnership, own funds of the enterprises.

Due to the high cost of capital investment, it is recommended that a funding mechanism be used through the city and state budget (e.g. national public funds, financial support programs).

Grants and cash in the form of loans from EU programs will also be an important element of financial support. Activities in the energy sector also provide an opportunity to organise cooperation on the basis of a public-private partnership and the use of private potential of private enterprises.

#### Implementation barriers / challenges

The main barriers and challenges in the implementation of actions in the Energy sector are:

- limited city control over the energy system - district heating and electricity networks are regulated by private entities or at government level;
- legal barriers: the existing 10H Act hindering the installation of wind turbines, the liquidation of the prosumer\* system for PV and the inability to create energy cooperatives in cities or legal solutions enabling the sharing of generated energy between buildings;

- implementation barriers due to high investment costs of the actions;
- the challenge of coordinating actions dependent on private and state stakeholders;
- the implementation of photovoltaic installations and the analysis of the potential for the implementation of such solutions in the city and outside the city, requiring good regional cooperation;
- the implementation of wind farm, distributed energy systems require upgrade of the grid management system.

#### Conditional requirements

To ensure implementation of capital projects and program implementation there were design enabling actions.

The actions in the section Equity and Inclusion focus on educating and tackling energy poverty. The City has Departments in place which are dealing with the subject of cooperating with the neighbourhood municipalities and units. The city has experience in LED retrofits and applies guidelines for preventing light pollution and related to sustainable external lighting policies.



## 5. GCCAP actions

### 5.4 Energy infrastructure actions

#### Enabling Actions

E1 Purchase of green energy for municipal units

E4 Development of a Municipal Hydrogen Program

E5 Creation of the Municipal Energy Agency

E6 Energy strategic partnership

E7 Creation of a Sustainable Energy Investments Fund



#### Capital projects & programs

E2 Generation of green Energy by the city within and outside Warsaw's borders

E3 Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral

E8 Outdoor city lighting – LED retrofit

#### Roles and partnerships

The implementation of the actions in the energy infrastructure sector will be coordinated by the Infrastructure Department which is strategically responsible for the supply of energy infrastructure to the city. A key partner in implementing the measures will be the Air Protection and Climate Policy Department, which is responsible for creating climate policy, including setting greenhouse gas reduction targets. The unit is also responsible for providing subsidies related to the implementation of investments in renewable energy sources (including photovoltaic and heat pump installations) and for the operation of the Municipal Photovoltaic Development Programme. A special role is played here by Municipal Water and Sewerage Company of the Capital City of Warsaw S.A., which, as the largest municipal consumer of electricity, has aspirations to become a climate-neutral electricity company. This is achievable by using our own electricity generation from renewable energy sources as early as 2030.

Actions related to the coordination of green energy production will require the involvement of the Faculty of Integrated Territorial Investments (European Fund & Development Policy Department) in metropolitan cooperation. In addition, important supporting units will be: Municipal Roads Authority in Warsaw, which is responsible for the modernisation of city lighting, and the Districts of the City of Warsaw, which are responsible for investment and maintenance of city buildings, as well as the development of renewable energy sources in city buildings and infrastructure managed by the districts. The actions related to the purchase and distribution of green energy will be carried out by the Warsaw Purchasing Group. A Green Purchasing Group is planned to establish bringing together buildings with photovoltaic installations. The group would also be responsible for procuring green energy and would allow a favourable way for the city to account for surpluses from renewable energy produced by city buildings.

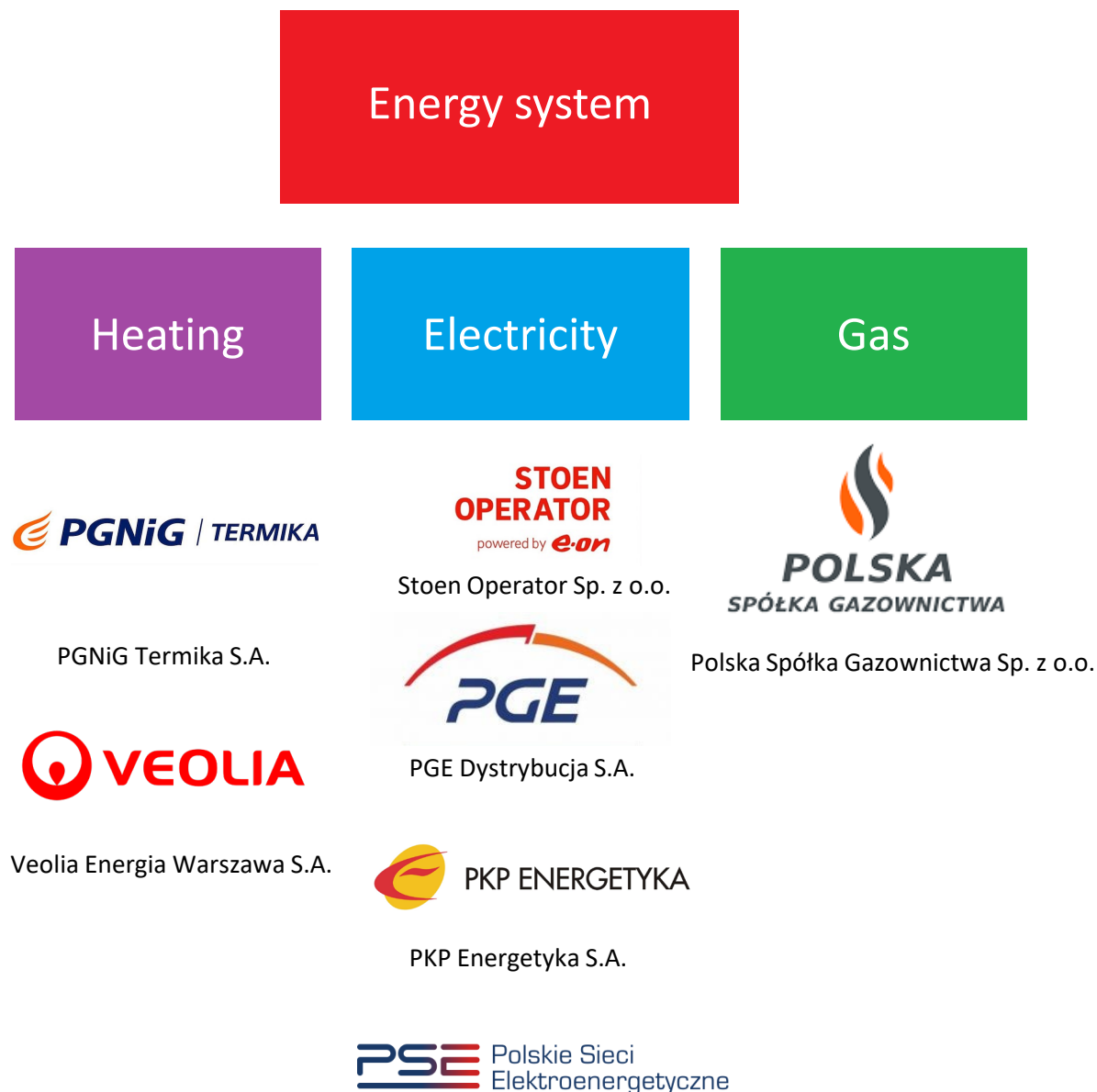
## 5. GCCAP actions

### 5.4 Energy infrastructure actions

#### Roles and partnerships cont.

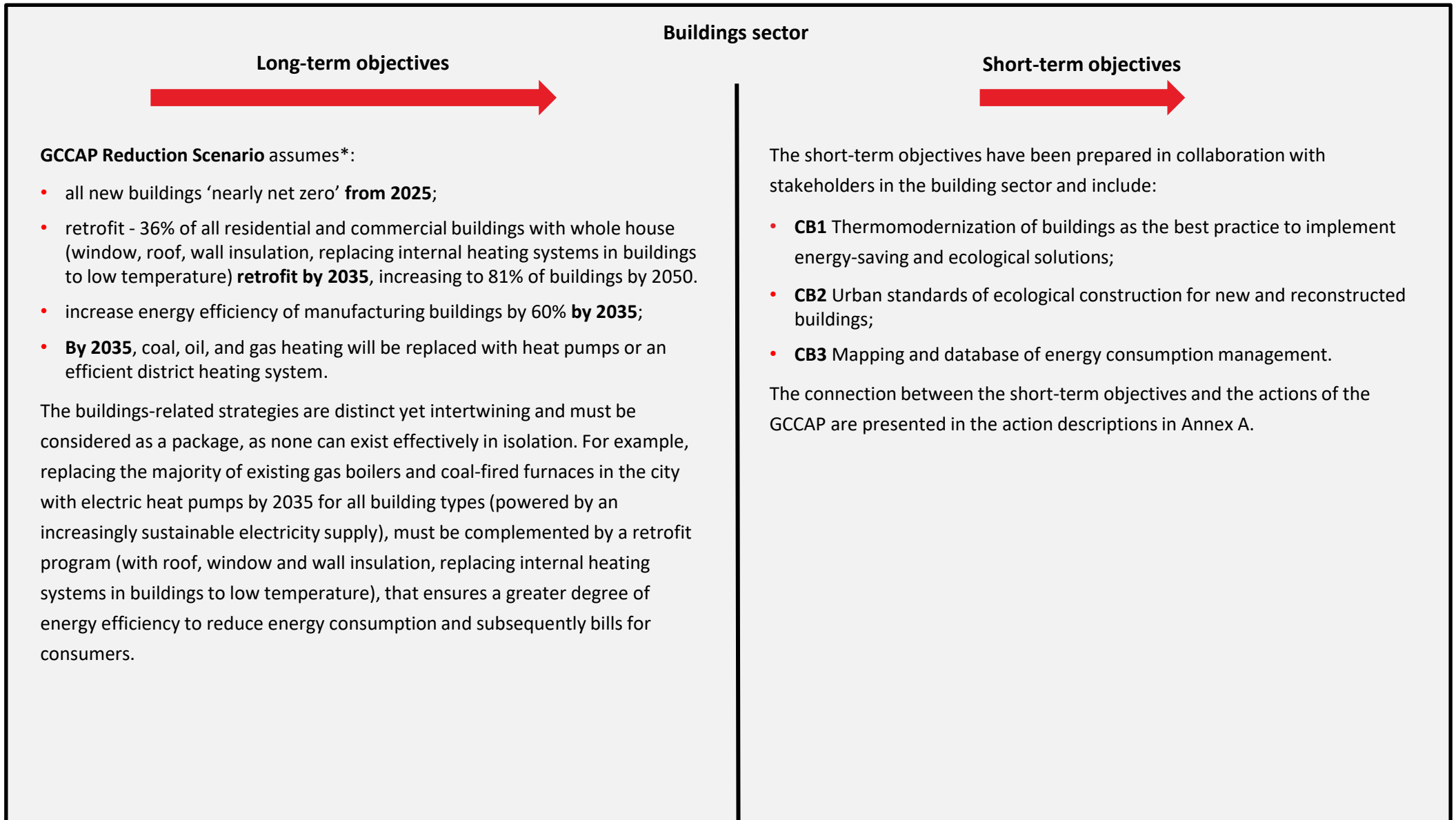
Creating a strategic partnership with the energy sector will require cooperation with key heat producers, owners of transmission networks, energy network operators, combined heat and power plants and representatives of the gas network, which are currently in the city:

- Veolia Energia Warszawa S.A.– a company managing the heating network, supplying system heat and hot water to 80% of buildings in Warsaw,
- Stoen Operator Sp. z o.o. - electricity network operator in Warsaw,
- PGE Dystrybucja S.A. - operator of the electricity distribution network in the area of the City of Warsaw,
- PGNiG Termika S.A. – owner of a heat and power plant in the city.,
- Polska Spółka Gazownictwa Sp. z o.o. - gas distribution system operator in Poland,
- Polskie Sieci Elektroenergetyczne S.A. - transmission grid operator in Poland, owner of the extra-high voltage grid.



## 5. GCCAP actions

### 5.5 Long-term and short-term objectives in the buildings sector



\* Long-term objectives were determined in relation to 2018.

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## 5. GCCAP actions

### 5.6 **Buildings** actions

Buildings in Warsaw generate the majority of GHG emissions, particularly from space heating. There are a total of around 89,000 residential buildings. Existing buildings are on average highly inefficient due to a multitude of factors, which creates additional issues around fuel poverty, amplified by the present-day context of prices increasing over 100%.

Energy poverty<sup>42a</sup> means a situation where a household run by one person or several people together in an independent flat or in a single-family residential building without economic activity cannot provide itself with a sufficient level of heat, cold and electricity to supply devices and lighting.

This can be influenced by several factors:

- structure of residential buildings;
- complex structure of residential buildings ownership and use;
- features of inhabited buildings: age, energy efficiency, size, parameters of the heat source;
- characteristics of households, including income;
- climatic conditions;
- prices of energy carriers.

One of the actions aimed at combating this type of poverty may be to support the implementation of investments related to the thermo-modernization

of buildings and the improvement of their energy efficiency.

With the roll out of smart metering and billing, and the forthcoming amendment to the Energy Law, there is potential for improvement.

Green City and Climate actions will build on current strengths to accelerate the direct upgrade of municipal buildings and incentivise building owners in the city to make necessary improvements to existing and new buildings.

#### **Key challenges**

- 1. Warsaw has aged and inefficient building stock, with poor energy efficiency compared with current standards.**
- 2. Electricity consumption in residential buildings is high, at 36 kWh/m<sup>2</sup> 43.**
- 3. Heat consumption in residential buildings is very high at 325 kWh/m<sup>2</sup> 44.**
4. As of December 31, 2021, it is estimated that between 7,500 and 9,000 households in the city use solid fuel stoves for heating. They are inefficient and contribute to air pollution.

5. Approximately 20% of households use individual gas boilers for heating.
6. Gas is used for cooking in 73% of households.

#### **Implemented activities**

Since 2017, subsidies have been provided for renewable energy sources and for the replacement of solid fuel furnaces. According to information on the website of the Warsaw City Council, in 2017-2021, the Capital City granted more than 4,400 subsidies for photovoltaics in the amount of more than 50 million PLN, with a total installed capacity of 34.6 MW.

According to data from Air Protection and Climate Policy Department, at the beginning of 2018, there were 18,000 households with solid fuel furnaces. In total, 4,310 fossil fuels were replaced between 2017 and 2021 using city funds: 2,794 in the private stock and 1,516 in the municipal stock.

In 2019-2021, Warsaw co-financed the installation of about a thousand heat pumps. There have been a number of initiatives aiming to improve energy efficiency in buildings, such as the widespread roll out of smart metering and billing.

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## 5. GCCAP actions

### 5.6 **Buildings** actions

#### **Implemented activities cont.**

The forthcoming amendment to the Energy Law will require Distribution System Operators to install smart meters in at least 80% of household consumers by 2028. A growing number of commercial real estate developments are gaining green certification, with 87% of new office space in Warsaw now certified.

There are also ongoing educational activities aiming to raise awareness on energy and resource efficient behaviour, including training sessions, panels, picnics, seminars and exhibitions, undertaken by the Partnership for Climate platform.

#### **Green City and Climate actions**

The actions have been developed to decarbonise and improve the energy efficiency of Warsaw's buildings – both private and public. They include supporting the implementation of standards in accordance with the provisions of the Warsaw Green Building Standard, as well as a retrofit program for our municipal buildings, and the development of incentives to encourage the upgrade of residential buildings. These are in line with the Warsaw Climate Panel's recommendations on improving building energy efficiency.

For municipal-owned buildings, the city will strive to retrofit all its stock by 2050, where it is technically and economically feasible.

For more detail on each action, see Appendix A: Green City and Climate Action Description.



Photo: m.st. Warsaw

## 5. GCCAP actions

### 5.6 **Buildings** actions

Table 13: GCCAP Buildings actions summary

ID	Action	Description	Type	Financial assessment			Estimated carbon emissions reduction*
				Pre-investment (EUR)	CAPEX (EUR)	OPEX (EUR/yr)	
B1	<u>Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction</u>	The city is in the process of proceeding Warsaw Green Building Standard, therefore this action will focus on supporting the implementation of standards in accordance with the provisions of the Standard and recommendations resulting from conservation protection, as part of activities related to modernization and renovation. Building sector is essential for enabling electric mobility.	Policy	76.6k	-	-	-
B2	<u>Program to improve the energy efficiency of municipal buildings with a pilot</u>	Modernization of municipal buildings, subsidies for private residential buildings and tools and incentives supporting the modernization of cooperative residential buildings in Warsaw, including: heat pumps, insulation energy efficiency measures in buildings, deployment of smart lighting in buildings to increase energy use savings, replacing internal heating systems in buildings to low temperature will help to improve poor building energy efficiency and reduce electricity and heat consumption. Conducting educational and information campaigns by the City of Warsaw on building thermo-modernisation.	Capital program	-	1.124bn	-	392 125 Mg CO <sub>2</sub> /yr

\* Estimated carbon reductions were only calculated for actions where this was possible at this stage (e.g. due to not knowing the scale, type and technology of implementation). A detailed assessment will be made at a later stage during e.g. the development of a feasibility study for an action.

## 5. GCCAP actions

### 5.6 **Buildings** actions

**Table 13: GCCAP Buildings actions summary**

ID	Action	Description	Type	Financial assessment			Estimated carbon emissions reduction*
				Pre-investment (EUR)	CAPEX (EUR)	OPEX (EUR/yr)	
B3	<u>Continued replacement of high-emission heat sources</u>	Continuation of the replacement of high-emission heat sources, including over 5,800 classless boilers or furnaces. According to the current city policy, when replacing solid fossil fuel heating sources, priority should be given to heat pumps as a new heat source along with photovoltaic installations.	Capital program	-	47.221m	157.7k	83 986 Mg CO <sub>2</sub> /yr

\* Estimated carbon reductions were only calculated for actions where this was possible at this stage (e.g. due to not knowing the scale, type and technology of implementation). A detailed assessment will be made at a later stage during e.g. the development of a feasibility study for an action.

## 5. GCCAP actions

### 5.6 **Buildings** actions

#### Action implementation

The focus will be on thermomodernisation and retrofit actions. Buildings with the worst energy efficiency should be modernized first. The action to retrofit municipal buildings and provide subsidies for private residential buildings in Warsaw for upgrade, include heat pumps, insulation measures, deployment of smart lighting and replacement of 7,600 solid fossil fuel heating sources. These are very important actions for the city to implement with the enormity of the challenges (incl. underestimated costs). This is a significant organisational and financial challenge for the City. The work will begin with the implementation of changes in the current energy and heat supply of buildings. Continuous cooperation and development of the city's partnership with the owners of Warsaw CHP plants and the distribution network will allow the city to actively participate in the process of transformation of the heating system towards its low-emission and then zero-emission. The city is in the process of developing the Warsaw Green Building Standard, which will be mandatory for the city owned buildings. Therefore, GCCAP actions in the building sector should primarily focus on supporting the implementation of the new norms in accordance with the provisions of the Warsaw Green Building Standard Standard.

The implementation of best practice standards will help to gradually refurbish buildings so that they can achieve lower levels of energy consumption. In addition, as part of the best practices and recommendations for thermal modernization and construction of buildings, regulations will be developed for existing installation systems in order to increase their efficiency and increase awareness of the desired behavior among users. Solutions implemented in municipal buildings can subsequently be used as an example for private, cooperative and newly built buildings. These projects will be used for educational and promotional material to popularise the need for energy modernisation of buildings.

#### Financing route

**Pre-investment costs:** 76,6k EUR (350k PLN)

**Capital expenditures:** 1,171bn EUR (5,348bn PLN)

**OPEX:** 157.7k EUR (720k PLN)

There are a number of suitable methods of financing for this sector. This includes:

- 1) city funds
- 2) EU Financial Support program
- 3) subsidies and funds from the support programs of the State Budget.

Due to the large capital investment costs, a City and State funding mechanism will be recommended.

Financial resources will mainly be obtained from public funds:

National Recovery Programme, European Funds Programme for Infrastructure, Climate, Environment; NFOŚiGW program , "Stop Smog", PoSEFF program "Polish Sustainable Energy Financing Facility". It will also be important to create favourable regulatory and economic conditions for private owners to start investments for their own needs.



Photo: m.st. Warsaw



## 5. GCCAP actions

### 5.6 **Buildings** actions

#### Implementation barriers / challenges

The greatest barrier and challenge to implementing actions in the building sector is related to the growing energy poverty and the need to develop support schemes in this area, great needs in the field of thermal modernization and improvement of the energy efficiency of buildings as well as the current economic situation and rising energy prices as well as prices of services and materials.

#### Conditional requirements:

The actions in the section equity and inclusion focus on educating and tackling energy poverty.

#### Roles and partnerships

The main stakeholders in implementing the actions in the buildings sector will be:

- The Air Protection and Climate Policy Department,
- Infrastructure Department.

In the process of implementing the indicated activities, the city can also count on the support of the Office of Housing Policy, Districts m.st Warsaw together with real estate management plants operating in their area, the Office of the Capital Conservator of Monuments, the Office of Economic Development, and Architecture and Spatial Planning Department.

#### Enabling Actions

Przygotowanie i wsparcie wdrożenia najlepszych praktyk i instrukcji w zakresie remontów i budowy budynków



#### Capital projects and programs

Program to improve the energy efficiency of municipal buildings with a pilot

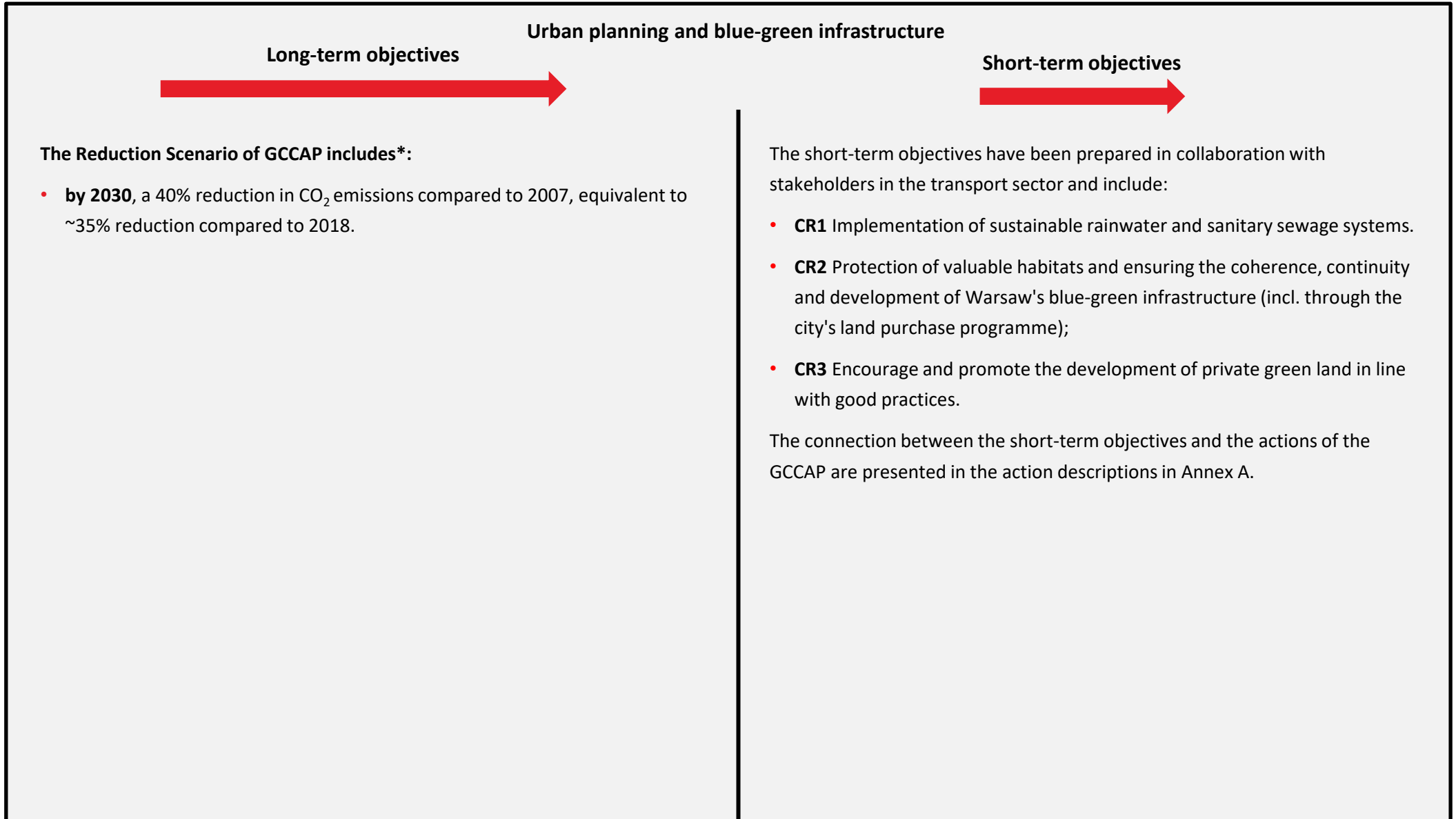
Replacement of high-emission heat sources



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## 5. GCCAP actions

### 5.7 Urban planning and blue-green infrastructure long-term and short-term objectives



\* Long-term objectives were determined in relation to 2018.

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## 5. GCCAP actions

### 5.8 Urban planning and blue-green infrastructure actions

Warsaw is a green city with an abundance of nature for residents to enjoy. Improving the green space within the city remains a priority. The proposed actions are also aimed at coordinating nature protection with planning documents, in order to ensure the protection of naturally valuable areas and provide ecosystem services to residents.

The city is characterized by a relatively low population density index, however, in the scale of districts there is a variation in population density depending on the degree of infrastructure development and differentiation of types and functions of buildings. The high intensity of development in the city center generates a number of challenges for the city, such as: heavy load on public infrastructure or the emergence of the urban heat island phenomenon. At the same time, it is possible to increase the density of buildings in selected areas of the city in order to limit the effect of city sprawl and ease the pressure on the environment.

#### Key challenges

- The city has an **uneven distribution of the population density in districts** (ranging from 990 residents/km<sup>2</sup> Wawer district to 8400 residents/km<sup>2</sup> Ochota district).

- Certain outer districts being underserved with **poor access to urban infrastructure and services**. Public investments on the outskirts of the city are expensive and do not meet the growing needs of the inhabitants.
- **Lengthy and complicated procedures** for preparing Local Spatial Development Plans make the process of protecting environmentally valuable areas additionally difficult, which makes it challenging to stop urban sprawl.
- Another obstacle to protecting areas of natural value is the **ownership status of the land, which is currently largely privately owned**. The desire to place them under protection results in demands for land buyouts from the owners.
- **Spillage of buildings in peripheral areas** can negatively affect the aerosanitary conditions in the central parts. Intensification of buildings may increase the risk of urban heat island, deterioration of air quality and threaten the natural environment.

#### Implemented activities

Climate challenges require sustainable management of urban lands. However, current regulations do not guarantee protection at an adequate level for lands that provide a range of ecosystem services.

Currently, the Green Management Standards Warsaw are being processed in the city. These are documents that form the executive basis of the urban greenery management system. Standards include:

- Standard of information about tree felling in Warsaw,
- Standard of dendrological reviews and analyses in Warsaw,
- The standard of protection of greenery in investment processes in Warsaw,
- The standard of creating and managing low greenery in Warsaw,
- Standard for cutting tree crowns in Warsaw,
- Standard of tree planting in Warsaw,
- The standard of activities aimed at protecting trees growing in Warsaw.

Currently, works are underway in the city related to the preparation of a new Study of conditions and directions of spatial development of Warsaw, which will be a response to the progressive climate change and will support the development of Warsaw as a resilient urban ecosystem.

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## 5. GCCAP actions

### 5.8 Urban planning and blue-green infrastructure actions

#### Green City and Climate actions

The Green City and Climate actions within this section focus on developing spatial planning measures to safeguard existing green space, as well as implementing targeted preservation and restoration programs in areas of particular ecological value, such as the Zakole Wawerskie. Actions also include increasing the share of greenery, including trees in public spaces and green areas in the city, as well as the widespread use of permeable surfaces and solutions based on nature, such as rain gardens, ditches and bioretention basins, in order to improve the city's resistance to hydrological and thermal hazards.

For more detail on each action, see Appendix A: Green City Action Description.



Photo: m.st. Warsaw

## 5. GCCAP actions

### 5.8 Urban planning and blue-green infrastructure actions

Table 14: GCCAP Urban planning and blue-green infrastructure actions summary

ID	Action	Description	Type	Financial assessment*			Estimated carbon emissions reduction**
				Pre-investment (EUR)	CAPEX (EUR)	OPEX (EUR/yr)	
R1	<u>Increasing biologically active surfaces and removing impermeable surfaces</u>	Redesign and reconstruction of impermeable surfaces in Warsaw in order to increase the share of biologically active surfaces. The implementation of blue - green infrastructure, including in particular nature-based solutions such as rain gardens, bioretention ditches and basins, green roofs and facades, would bring multi-dimensional benefits for city resilience, biodiversity and the well-being of its inhabitants. There is a potential to transform impermeable surfaces and introduce more biologically active surface at these sites. Such actions may take place in squares, pavements, squares, cemeteries, parts of parking spaces and other impermeable areas.	Capital program	-	61.055m + 3.5k per m <sup>2</sup>	106.5k + 1,6 per m <sup>2</sup> + 49.4 per ha	-
R2	<u>Protection and restoration of valuable green areas</u>	Development and implementation of a program aimed at the protection of naturally valuable areas and their organized provision to residents. The program will include activities to protect valuable natural areas of the city, increase and preserve biodiversity, protect the hydrographic system, increase the number of areas with retention functions, preserve meadow and agricultural areas in the city, increase public access to green areas and other open areas, together with running educational activities in the field of protection of these areas. An indispensable element of the activity will be maintaining and developing a spatial database concerning areas of natural value.	Capital program	405.6k	118m	121k + 0.3k per ha	-

\* For unit prices, in-depth research is needed to identify the specific needs of the city.

\*\* Estimated carbon reductions were only calculated for actions where this was possible at this stage (e.g. due to not knowing the scale, type and technology of implementation). A detailed assessment will be made at a later stage during e.g. the development of a feasibility study for an action.

## 5. GCCAP actions

### 5.8 Urban planning and blue-green infrastructure actions

**Table 14: GCCAP Urban planning and blue-green infrastructure actions summary**

ID	Action	Description	Type	Financial assessment*			Estimated carbon emissions reduction**
				Pre-investment (EUR)	CAPEX (EUR)	OPEX (EUR/yr)	
R3	<u>Preservation &amp; restoration of urban greenery Zakole Wawerskie</u>	Protection of valuable green areas and other valuable open areas of the Zakole Wawerskie against further urbanization pressure. The allocation of funds for the purchase of land will be carried out in parallel with the creation and adoption of the local development plan for this area. The action will support the protection of urban wetlands, the aim of which is to improve water retention, protect biodiversity, climate and air quality.	capital program		49.1m	1.35m	-
R4	<u>Greening streets</u>	Implementation of an action program for the reconstruction of streets along with their greening and ensuring the comfort and safety of use. The program should provide for sustainable and universal design of public spaces, taking into account the needs of all users and functions: public transport, individual transport, parking, walking, cycling and recreation.	capital program	142k	35.5m + 458.3 2k/km	115k	Tree planting: 12 tCO <sub>2</sub> /yr Traffic reduction: 6 000 tCO <sub>2</sub> /yr

\* For unit prices, in-depth research is needed to identify the specific needs of the city.

\*\* Estimated carbon reductions were only calculated for actions where this was possible at this stage (e.g. due to not knowing the scale, type and technology of implementation). A detailed assessment will be made at a later stage during e.g. the development of a feasibility study for an action.

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## 5. GCCAP actions

### 5.8 Urban planning and blue-green infrastructure actions

#### Action implementation

The city is developing a new study of the conditions and directions of spatial development, which will strengthen the role and importance of the blue-green infrastructure in the city. The findings of the new study are the basis for local spatial development plans, which have a direct impact on the method of land development in the city.

The implementation of the GCCAP actions will be multi-stage. Some of the actions are ready to be implemented on the basis of the city development concept. For these actions, the first step will be to select a contractor. For other GCCAP actions, there is a need to prepare feasibility studies, programs and budget.

#### Financing route

**Pre-investment costs:** 547,6k EUR (2,5m PLN)

**Capital expenditures:** 263,655m EUR (1,207bn PLN)

**OPEX:** 1,692m EUR (7,762m PLN)

#### Suitable methods of financing

- City and State budget,
- EU-financial support program,

- Private Investment and funds of private enterprises.

Due to the high cost of capital investment, it is recommended that a funding mechanism be used through the city and state budget. This budget can be supported by financing from EU-financial support programs e.g., European Funds for Infrastructure, Climate, Environment Program 2021-2027. Private investment will also contribute to the development and implementation of the GCCAP activities.

#### Significant barriers / challenges related to the implementation of activities

The main barriers and challenges in the implementation of actions in Urban planning and blue-green infrastructure sector are:

- high investment costs of actions;
- insufficient possibilities of providing tools for the protection of naturally valuable areas in the planning system;
- the necessity to purchase private land intended in the local plan for public purpose investments, including public roads, squares and parks, or to pay the owners of these lands financial compensation for preventing or limiting the use of the property in the current manner;

- lack of external funds for the purchase of land and the related limitation of the possibility of protecting endangered species of plants and animals, and natural habitats threatened with extinction and hindered possibilities of creating new public green areas;
- high building pressure on naturally valuable areas;
- lengthy procedures to ensure the protection of valuable areas;
- conflicts and resistance from investors and owners;
- the need to increase the awareness of residents about the importance of protecting valuable spaces and the benefits of implementing the blue-green infrastructure of Warsaw;
- conflicts and social resistance related to the change of transport priorities.

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## 5. GCCAP actions

### 5.8 Urban planning and blue-green infrastructure actions

#### Conditional requirements

Actions in the sector of urban planning and blue-green infrastructure focuses on implementing solutions that promote: the development of this infrastructure, the protection of valuable natural areas, the development of green areas and the greening of streets and the creation of comfortable and friendly spaces. It is necessary to intensify efforts to identify areas of natural value, and then proceed to adopt local land use plans for areas of natural value, giving these efforts priority in city policy, starting in 2023, including by setting aside appropriate financial resources in the budget of Warsaw to ensure that 100% of these areas are protected through planning by 2030.

#### Roles and partnerships

**Increasing biologically active surfaces and removing impermeable surfaces**, in this action, the role of the leader will be played by the Environmental Protection Department. On the other hand, the key department supporting the implementation of the provisions of this action will be the Architecture & Spatial Planning Department which will be responsible for the development of the study and spatial plans. In addition, another department supporting the performance of the action will be, among others the Air Protection and Climate Policy Department. Other units responsible for the implementation of the assumptions of the action will be, among others: Greenery Board of the Capital City of Warsaw and Municipal Roads Authority (units responsible for unsealing road lanes and their greening).

**Protection and restoration of valuable green areas**, the Environmental Protection Department will again play a leading role in this action. As in the case of the two previous actions, the key partner will be the Architecture & Spatial Planning Department, responsible for the preparation of the study and spatial plans. The department supporting the implementation of the measure will be the City & State Treasury Property Department which will assist in the purchase of land necessary for the protection of these areas. Additional assistance will also be provided by the Greenery Board of the Capital City of Warsaw and the Air Protection and Climate Policy Department.

#### Capital projects & programs

R1 Increasing biologically active surfaces and removing impermeable surfaces

R2 Protection and restoration of valuable green areas

R3 Preservation & restoration of urban greenery Zakole Wawerskie

R4 Greening streets



## 5. GCCAP actions

### 5.8 Urban planning and blue-green infrastructure actions

#### Roles and partnerships cont.

##### **Preservation & restoration of urban greenery Zakole**

**Wawerskie**, the role of the leader will be once again performed by the Environmental Protection Department. On the other hand, the main supporting departments will be the Architecture & Spatial Planning Department, whose task will be to prepare a spatial development plan to protect this area, and the City Property and the State Treasury Department, responsible for the payment of compensation and purchase of private land necessary for active protection of this area. In addition, the unit supporting the implementation of the measure will be, among others: the Air Protection and Climate Policy Department.

**Greening streets**, responsible for the implementation of this action will be the Municipal Roads Authority. The key departments that will support the implementation of the provisions of the assumed actions will be, among others: the Architecture & Spatial Planning Department, Greenery Board of the Capital City of Warsaw and Road Traffic Management Department.



Photo: City of Warsaw



Warsaw



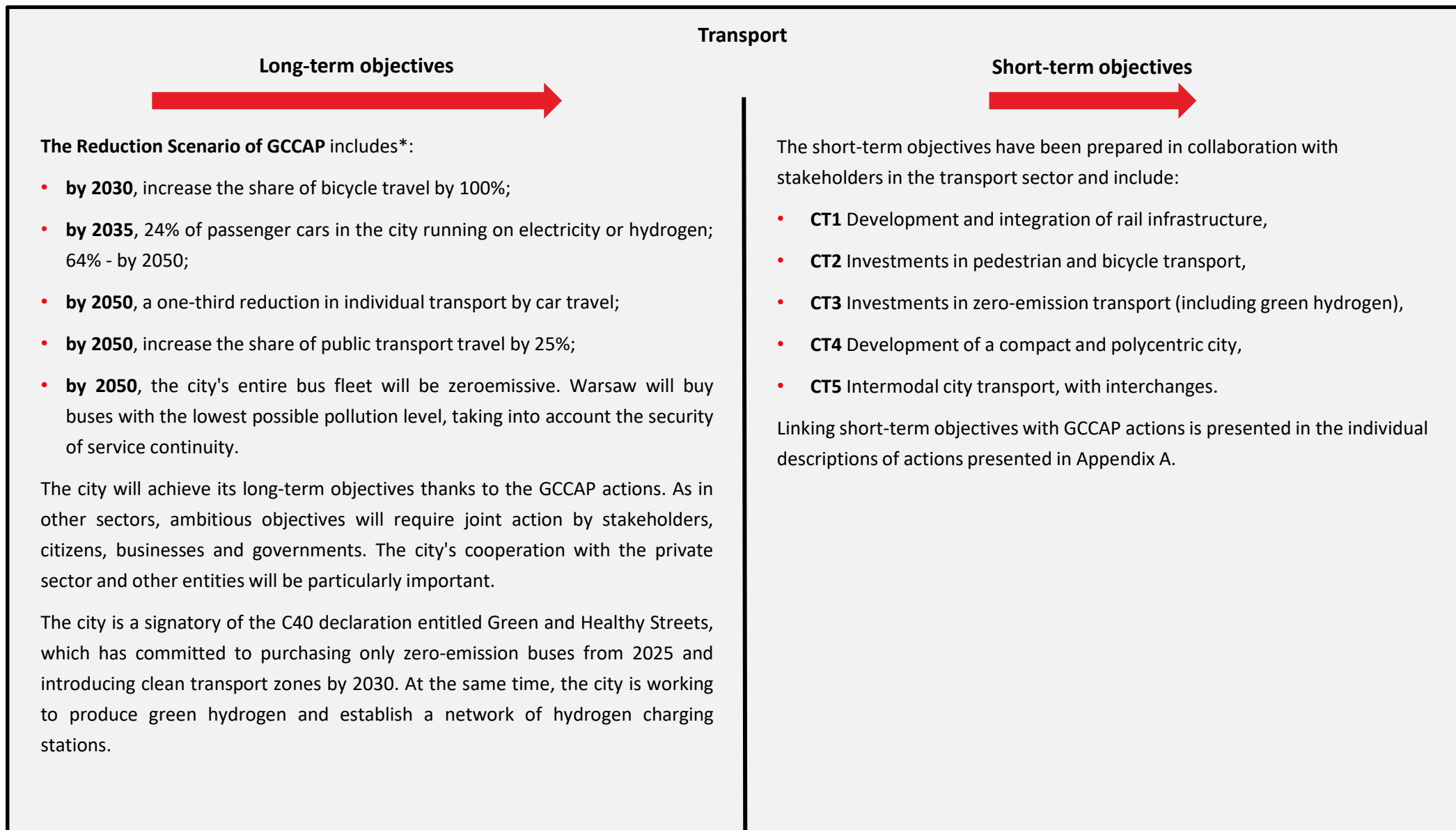
City Forests in Warsaw



Greenery Board of the Capital  
City of Warsaw

## 5. GCCAP actions

### 5.9 **Transport** long-term and short-term objectives



\* Long-term objectives have been set against the base year (2018).

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## 5. GCCAP actions

### 5.10 **Transport** actions

The transformation of the transport sector is extremely important in the efforts of Warsaw to climate neutrality. The actions are designed to complement the city's existing efforts to change the behavior of road users and to increase the share of cycling, walking and public transport in the city. Actions are also intended to help ensure clean, safe, efficient, low-carbon transport for every citizen.

#### Key challenges

1. The transport sector is **one of the main sources of air pollution** and accounts for around 17% of Warsaw's 2018 GHG emissions.
2. **Road congestion** is a persistent issue in the city center. This is exacerbated by the limited number of crossings over the Vistula River which causes poor accessibility of some areas of the city, especially those located on the eastern side of the Vistula.
3. A high share of **cars in the city are diesel** (35%), significantly contributing to high levels of air pollution.

4. Warsaw's **vehicles** (passenger cars and other means of private transport) **are old and inefficient**, with an average age of 15 years.
5. **Private car use is very high** within the city, with an average number of vehicles per capita of 0.8.
6. **Cycling represents just 7,5%** of journeys taken in the city.

#### What we are already doing

Warsaw strives to improve the attractiveness and sustainability of the transport sector by supporting appropriate communication behavior of its inhabitants. Warsaw is conducting and planning significant investments in the public transport system, such as the extension of Line II of the metro and the construction of Line III of the metro. So far, Miejskie Zakłady Autobusowe has acquired 260 low-emission vehicles powered by LNG CNG and 160 electric buses.

Work is underway on a new Sustainable Urban Mobility Plan (SUMP), the most important of which is the introduction of low-emission transport and a shift away from the use of passenger cars.

#### GCCAP actions

GCCAP actions were designed to perform the most important tasks and meet the challenges faced by the transport sector in the city.

These are six capital programs, that:

- improve environmentally friendly public transport services and provide electric car sharing services,
- facilitate multimodal transport,
- expand the network of tram and metro lines,

The actions will support the new, integrated transport policy, which will be supported by research on the needs of public transport.

More details on each action are provided in Appendix A: Green City Action Description.

## 5. GCCAP actions

### 5.10 Transport actions

Table 15. GCCAP Transport actions summary

ID	Action	Description	Type	Financial assessment			Estimated carbon emissions reduction*
				Pre-investment (EUR)	CAPEX (EUR)	OPEX (EUR/yr)	
T1	<u>Continued expansion of municipal integrated rail transport</u>	Expansion of rail transport connections (trams, metro) in the city center and in the peripheral districts, and replacement of the currently used rolling stock with a modern one. The commencement of implementation requires a detailed analysis of the needs of public transport users and the possibility of building a network of rail transport connections and transfer stations in densely populated suburbs.	capital program	1.677m	722.867m	47.8m	-
T2	<u>Convenient and safe zero-emission public transport</u>	City-wide deployment of new electric or alternative (e.g., hydrogen) buses to reduce air pollution and deliver visible change for residents to increase the comfort and safety of public transport.	capital program		969.1m	35.6m	115 400 Mg CO <sub>2</sub> /yr
T3	<u>Development of transport interchange and communication hubs</u>	Communication hubs will support the growth of a thriving multimodal transport system. Multimodal hubs will be built in strategic locations where different types of urban transport connect, improving the convenience and comfort of passengers. Depending on the location, the existing stations are to be reconstructed, expanded or new ones built.	capital program	888k	40.3m		-

\* Estimated carbon reductions were only calculated for actions where this was possible at this stage (e.g. due to not knowing the scale, type and technology of implementation). A detailed assessment will be made at a later stage during e.g. the development of a feasibility study for an action.

## 5. GCCAP actions

### 5.10 Transport actions

Table 15. GCCAP Transport actions summary

ID	Action	Description	Type	Financial assessment			Estimated carbon emissions reduction*
				Pre-investment (EUR)	CAPEX (EUR)	OPEX (EUR/yr)	
T4	<u>Support for the development of electromobility</u>	Supporting expansion of electric vehicles, car sharing and travel sharing systems, a public city-wide network of EVs, parking and charging stations as a way to reduce the number of car trips, reduce emissions of pollutants and greenhouse gases, free up places for pedestrians and cyclists and reduce journey times.	enabling		11.2m	560k	-
T5	<u>Research on public transport needs</u>	Personalised research on transport needs will contribute to making public transport more accessible and safer. Understanding user needs will lead to better planning and resource efficiency.	enabling	76.6k			-
T6	<u>Program supporting the implementation of Clean Transport Zones</u>	Conducting in-depth feasibility studies for Clean Transport Zones with an indication of the need for the location of additional Park&Ride Parking. Reducing the number of vehicles in some parts of the city will help to quickly reduce traffic and air pollution. In the longer term, however, it will create an incentive for the development of the market for low-emission vehicles.	capital program	76.6k			-

\* Estimated carbon reductions were only calculated for actions where this was possible at this stage (e.g. due to not knowing the scale, type and technology of implementation). A detailed assessment will be made at a later stage during e.g. the development of a feasibility study for an action.

## 5. GCCAP actions

### 5.10 Transport actions

Table 15. GCCAP Transport actions summary

ID	Action	Description	Type	Financial assessment			Estimated carbon emissions reduction*
				Pre-investment (EUR)	CAPEX (EUR)	OPEX (EUR/yr)	
IT1	<u>Integrated ticketing for the agglomeration as a part of public transport managment</u>	Integration urban policies and the development of tools to facilitate central transport management in the city will improve access to flexible and easy multimodal travel. This includes further expanding the electronic ticketing system for buses, trams, metro, trains, bicycles, electronic vehicle monitoring and transport management as a way to improve user comfort and increase the use of public transport services.	capital program		28.55m		-
IT2	<u>Smart local energy systems including vehicle-to-grid and vehicle-to-building</u>	Assessment and concept development for the implementation of <i>vehicle-to-grid</i> system and <i>vehicle-to-building</i> application, including basic bidirectional charging solutions, as a future tool to reduce energy demand, increase renewables and reduce fossil fuels.	capital program	186k			-

\* Estimated carbon reductions were only calculated for actions where this was possible at this stage (e.g. due to not knowing the scale, type and technology of implementation). A detailed assessment will be made at a later stage during e.g. the development of a feasibility study for an action.

## 5. GCCAP actions

### 5.10 **Transport** actions

#### Action implementation

The actions in the transport sector have proposed a number of capital projects and programs, the implementation of which will be supported by support measures. These actions include the study of the needs of current and future users of the entire transport system and the development of rules for sharing vehicles in the city. It will be important to properly prepare pre-design work and feasibility studies.

#### Financing route

**Pre-investment costs:** 2,905m EUR (13,275m PLN)

**Capital expenditures:** 1,772bn EUR (8,092bn PLN)

**OPEX:** 83,96m EUR (383,5m PLN)

#### Suitable methods of financing

The scale and projected costs meet the criteria set for EU financial support programs and municipal financing. It is also an opportunity to develop cross-sector cooperation.

#### Implementation barriers / challenges

The main barriers and challenges in the implementation of transport actions are:

- traffic difficulties and drivers' opposition to the implementation of low-emission zone solutions;
- the operation of the vehicle-grid system implementation requires a number of other investments (photovoltaic production, grid change);
- the development of car-sharing and the policies for sharing EVs is associated with a barrier related to the insufficient number of charging stations in the city;
- Car sharing relies on a mobile phone or Wi-Fi, which may exclude poor or vulnerable populations from using the mobile devices.

#### Conditional requirements

Undertaking supporting actions is necessary to implement capital projects and programs. Conducting educational campaigns will contribute to increasing the awareness and knowledge of the inhabitants and will encourage wider use of public transport, cycling and walking.

Solutions have also been developed that will accelerate the wider use of the car sharing system.

#### Supporting actions

T5 Research on public transport needs

T4 Support for the development of electromobility

T6 Program supporting the implementation of Clean Transport Zones



#### Capital projects & programs

T3 Development of transport interchange and communication hubs

T1 Continued expansion of municipal integrated rail transport

IT1 Integrated ticketing for the agglomeration as a part of public transport management

T2 Convenient and safe zero-emission public transport

IT2 Smart local energy systems including *vehicle-to-grid* and *vehicle-to-building*

## 5. GCCAP actions

### 5.10 Transport actions

#### Roles and partnerships

The main units responsible for the implementation of actions in the transport sector will be: Infrastructure Department, the Public Transport Authority in Warsaw, Architecture & Spatial Planning Department, Municipal Roads Authority and Road Traffic Management Department. The units supporting the implementation of the actions will include: European Funds & Development Policy Department, Economic Development Department and It Department.

The city companies listed below have been identified as suitable partners for the implementation of a zero-emissions transport system.

#### Local government companies

- Miejskie Zakłady Autobusowe Sp. z o. o. (MZA) in Warsaw - operator of bus lines,
- Metro Warszawskie Sp. z o. o. – a subway operator,
- Szybka Kolej Miejska Sp. z o. o. (SKM) – a municipal rail operator,
- Tramwaje Warszawskie Sp. z o. o. – a tram operator,

#### Regional carriers

- Koleje Mazowieckie Sp. z o. o. (KM) – a regional rail operator,
- Warszawska Kolej Dojazdowa Sp. z o. o. (WKD) - a regional rail operator.

#### Local bus companies that provide public transport services\*

- Mobilis Sp. z o.o.,
- PKS Grodzisk Mazowiecki Sp. z o.o.,
- Arriva Sp. z o.o.,
- Michalczewski Sp. z o.o.
- Komunikacja Miejska Łomianki Sp. z o.o.



Public Transport Authority



Szybka Kolej Miejska Sp. z o. o.



Tramwaje Warszawskie Sp. z o. o.



Miejskie Zakłady Autobusowe Sp. z o. o.



Metro Warszawskie Sp. z o. o.



Koleje Mazowieckie Sp. z o. o.



Warszawska Kolej Dojazdowa Sp. z o. o.



Komunikacja Miejska Łomianki Sp. z o.o.



Mobilis Sp. z o.o.



PKS Grodzisk Mazowiecki Sp. z o.o.,



Arriva Sp. z o.o.



Michalczewski Sp. z o.o.

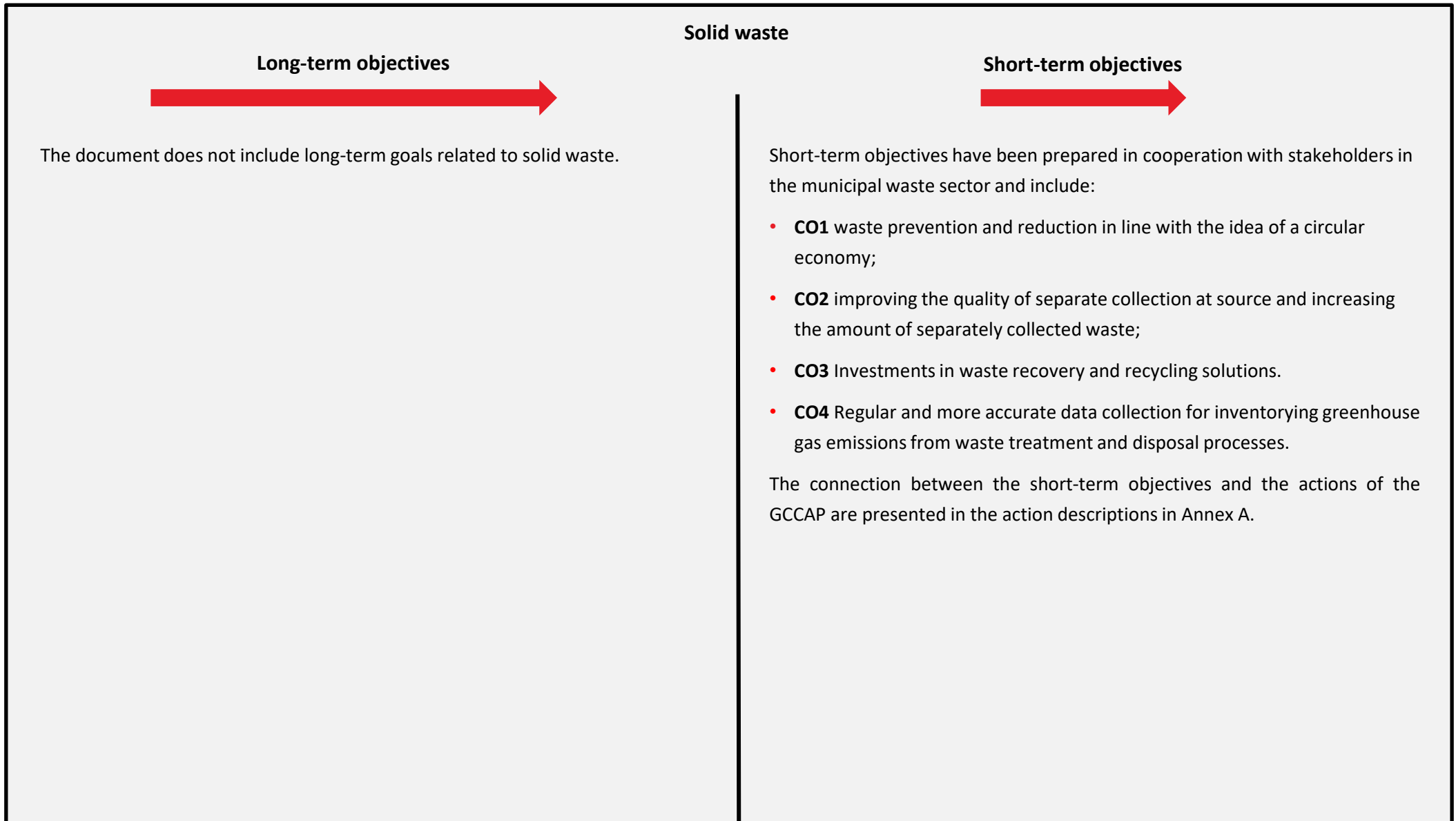
\* The presented list of bus companies is in accordance with the 2021 Report of the Public Transport Authority in Warsaw (May 2022)



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## 5. GCCAP actions

### 5.11 Solid waste long-term and short-term objectives



\* Long-term objectives were determined in relation to 2018.

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## 5. GCCAP actions

### 5.12 **Solid waste** actions

The waste sector has improved significantly in recent years. Since 2015, the level of municipal waste recycling achieved by the City has been increasing every year (in relation to the average level of waste recycling in the country). The number of tones of waste generated per capita in recent years has been variable and has both an upward and downward trend compared to previous years.

In order to reach the goal of climate neutrality by 2050, there is a need to reduce the amount produced, increase recycling rates, and embed principles of circular economy within the waste sector.

#### **Key city conditions**

- The quantity of **waste generated per capita is above the national average** and requires reduction.
- **The level of municipal waste recycling achieved by the City in 2020 is 42%**. However, recycling levels will have to increase significantly to meet the objectives of the EU Circular Economy Action Plan and the requirements of the Act on maintaining cleanliness and order in municipalities, which require the City to achieve a recycling level of 60%.

- **Sorting and segregation of waste at the source requires improvement**, including through increased knowledge and behaviour change.

#### **What the city is already doing**

- In Warsaw, the "Waste Prevention program for the Mazowieckie Voivodeship" is being implemented (Mazowieckie Voivodeship Board, 2018).
- Since 2019, separate collection of waste has been obligatory with increased fees for non-compliance, as set out in the Act on Maintaining Cleanliness and Order in Municipalities.
- There is an ongoing development of a thermal waste incineration plant, with a target capacity of about 305,200 tonnes/year.
- **Support for achieving objectives**

Improve data collection for the GHG inventory for waste disposal and incineration.

#### **Green City actions**

The actions developed to improve the solid waste sector within Warsaw build on existing plans, programs and include the development of new household waste recycling centres. Two centres will be equipped with a point of repair and re-use of non-waste products, as well as provide a place for selling or replacing items, in line with the principles of a circular economy.

There are also plans to build a new biogas plant to process and recover energy from food streams and other organic waste. The implementation of investment will allow waste disposal in the city and prevent transport of waste over long distances (to other cities) for waste treatment and disposal, which is the current practice.

For more detail on each action, see Appendix A: Green City Action Description.

## 5. GCCAP actions

### 5.12 Solid waste actions

Table 16. GCCAP Solid waste actions summary

ID	Action	Description	Type	Financial assessment			Estimated carbon emissions reduction*
				Pre-investment (EUR)	CAPEX (EUR)	OPEX (EUR/yr)	
Ok1	<u>Municipal biogas plants development program</u>	Development of biogas production in the city from food and other organic waste streams. The development of the plants would be subject to detailed feasibility and business case assessment.	capital program	27.4k	50.214m	6.674k	5,600 tCO <sub>2</sub> /yr
Ok2	<u>HWRC - Household waste recycling centres</u>	Creation of Household waste recycling centres (HWRC), which ensure the collection of, among others, waste paper, metals, plastics, glass, multi-material packaging waste, hazardous waste, expired medicines and chemicals, waste batteries and accumulators, waste electrical and electronic equipment, furniture and other bulky waste, used tires and waste textiles and clothing, as well as waste construction and demolition of households	capital program	328.5k	2.041m	1.2m	-

\* Estimated carbon reductions were only calculated for actions where this was possible at this stage (e.g. due to not knowing the scale, type and technology of implementation). A detailed assessment will be made at a later stage during e.g. the development of a feasibility study for an action.

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## 5. GCCAP actions

### 5.12 **Solid waste** actions

#### **Action implementation**

The implementation of the actions will be multi-stage. Firstly, detailed feasibility assessments would need to be conducted for the building of a biogas plant and the development of household waste recycling centres. This would include location analysis, concept preparation and business justification. Secondly, a construction design would need to be developed followed by efforts to secure funding and select a contractor.

When planning an investment, the following stages should be implemented: determining the method of operation of waste management facilities, the method of waste collection and proper waste management. The final stage will be the construction of waste management facilities.

#### **Financing route**

**Pre-investment costs:** 355.9k EUR (1.625m PLN)

**CAPEX:** 50.214m EUR (229.3m PLN)

**OPEX:** 6.674m EUR (30.470m PLN)

#### **Suitable methods of financing:**

- City Funds,
- EU-financial support program,

- Private investment and funds of private enterprises.

Due to the large scale and high capital expenditure, municipal and private financing is appropriate. This is an opportunity to develop cross-sector cooperation.

Funding from EU financial programs will also be an important element. A recovery & resilience facility and the European Funds for Infrastructure, Climate and Environment Program 2021-2027 may enable the implementation of investments.

#### **Implementation barriers/challenges**

The main barriers and challenges in the implementation of actions in the solid waste sector are:

- high investment costs of building a biogas plant;
- ensuring accessibility to household waste and recycling centres;
- insufficient awareness of residents in the aspect of municipal waste segregation in households and selective collection;

- residents may be resistant to the development of waste management facilities in their areas due to possible odour problems;
- Avoiding perverse incentives created through the large scale incineration plant and actions focused on waste reduction, segregation and recycling;
- the need for additional investment in information campaigns – awareness and understanding of the need for separation and recycling of waste for residents.

#### **Conditional requirements**

To implement the actions in waste sector it is important there is a need to develop support schemes in this and a recognising analysing the possible financial support, education tools.

## 5. GCCAP actions

### 5.12 **Solid waste** actions

#### Roles and partnership

**Municipal biogas plants development**, Municipal Cleaning Company in particular will be responsible for the implementation of this action. Support in the process of achieving and meeting the assumptions of this investment will be provided by the Infrastructure Department.

**HWRC - Household waste recycling centres**, The role of the leader will again be performed by the Waste Management Office. On the other hand, the partner of this action will be the Municipal Cleaning Company. From 2019, the City entrusted municipal waste management to this municipal commercial company. The company is responsible for the processing of waste in the first place in its own installations, and in the event of a lack of processing capacity, it selects third parties to manage the waste. The Municipal Waste Company implements and plans to implement such projects in the city as construction of a thermal waste treatment installation, construction of a biogas plant, construction of a recycling and ecological education centre.

#### Capital projects and programs

Municipal biogas plants development program

HWRC - Household waste recycling centres



Municipal Cleaning Company



Warsaw

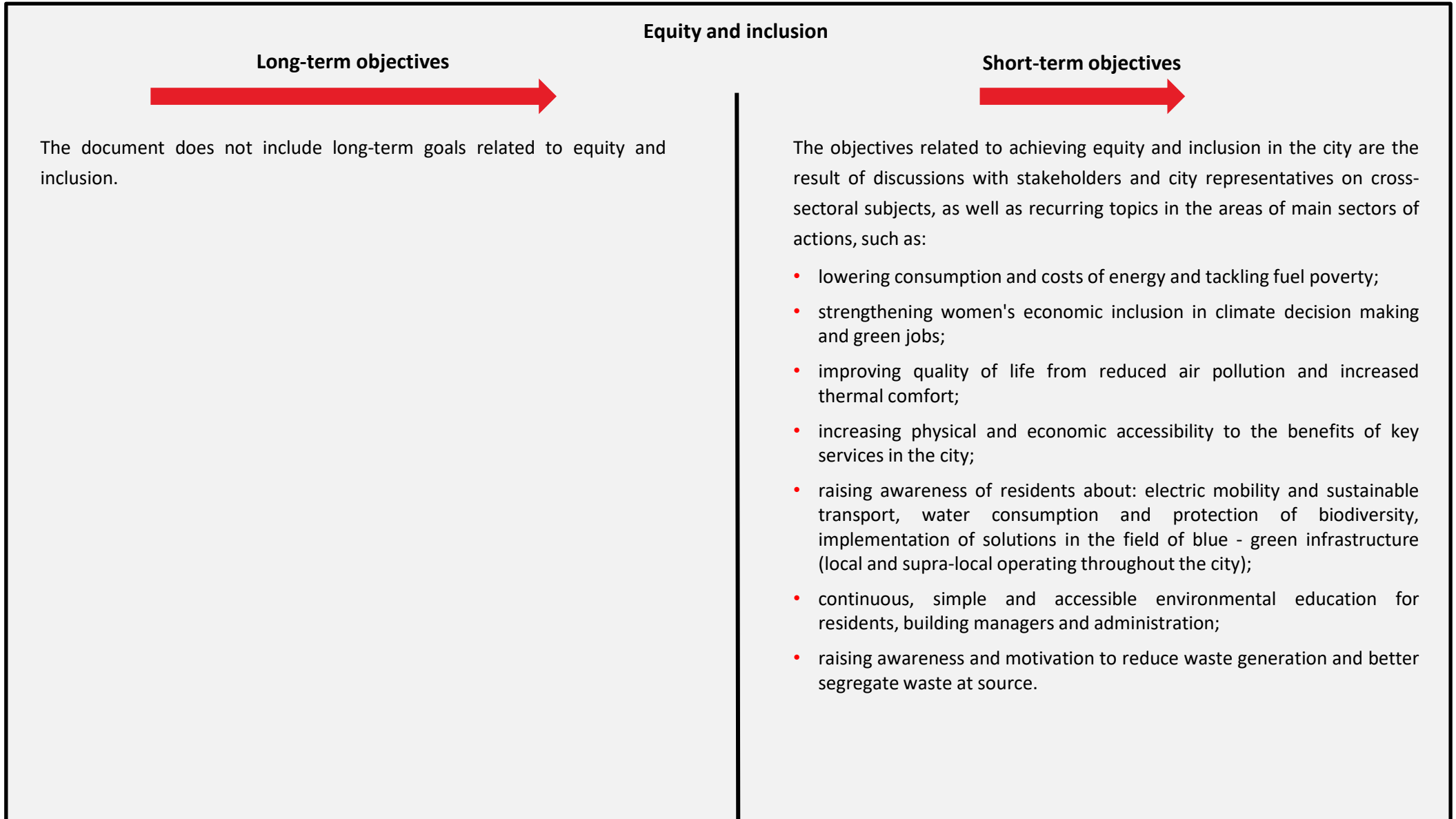


Photo: City of Warsaw

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## 5. GCCAP actions

### 5.13 Equity and inclusion long term and short term objectives



\* Long-term objectives were determined in relation to 2018.

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## 5. GCCAP actions

### 5.14 **Equity and inclusion** actions

Warsaw is the biggest economic centre in Poland. Many initiatives at the national and municipal level such as Warsaw Climate Panel, as well as the numerous NGOs operating on the territory of the City, contribute to the development of a greener and more sustainable city. However there are many environmental, urban and social challenges resulting the poor air quality and a high economic and social differentiation between districts. In terms of social issues, migration to the city, gender and minority equality, access to urban services as well as rising citizen engagement was among the key issues shaping development of the GCCAP.

#### **Key city conditions**

- Despite the aging population on a national level, Warsaw is a city full of young, proactive people, who are willing to be involved in the environment and climate change protection initiatives.
- According to the reports from 2016, energy poverty in households living in single-family houses, in Polish cities with more than 100,000 inhabitants affects 7.8% of all households.

- Rising inflation and the war in Ukraine are translating into intense increases in the prices of services, food, imports and energy. In the context of the current war crisis and the related energy crisis, residents are cautious in making decisions regarding the replacement of coal stoves.
- The growing population in the city (due to the war in Ukraine) results in increasing pressure on the city's infrastructure. This may be related to the increased demand for access to education and health care, increased demand on the real estate rental market, increased car traffic and an increase in the number of people using public transport.
- Help implementing solutions which will reduce air pollution (by replacing heating sources that are not suitable for the assumed goals), improving comfort and well-being with consideration of vulnerable groups, and groups which suffer from energy poverty.
- Behaviour change requires a sustained and varied campaign of education and information.

#### **What the city is already doing**

The City of Warsaw has many campaigns and education programs in place. It is important to expand them, as well as create new campaigns for newly implemented solutions. The GCCAP proposes the implementation of new initiatives, the continuation and support for the city's ongoing initiatives.

The implementation of all actions should be monitored to observe and anticipate potential social groups, that will require a support program in order not to exclude them and prevent energy poverty of users.

Rising inflation, fossil fuel prices, war in Ukraine require from the city accelerating action on tackling the energy poverty problem in the city. In April 2022 the City of Warsaw joined the C40 program: *Emergency Plan to Tackle the European Energy Crisis and Protect Residents.*

## 5. GCCAP actions

### 5.14 **Equity and inclusion** actions

#### **What the city is already doing cont.**

The city has signed the European Charter for Gender Equality in Local Life (in 2021) and the LGBT+ Declaration (in 2019). Warsaw implements a program of combating discrimination and equal opportunities, a program of supporting the development and ensuring safety, as well as equal access for women and men to health care and education.

The Warsaw Women's Council was established in the city, whose tasks include: developing an action plan for women, giving opinions on actions taken in the field of equality and respecting women's rights, including those related to family policy, access to health care, protection against violence, activation professional and equality in all areas of life.

#### **Green City actions**

The Green City actions within this section focus on cross sectoral subjects on equity and inclusion to ensure good implementation of the actions, by providing education, knowledge and help change behaviours. One of the actions is targeting elimination of energy poverty by ensuring access to clean and accessible energy.

For more detail on each action, see Appendix A: Green City Action Description.



Photo: City of Warsaw



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## 5. GCCAP actions

### 5.14 **Equity and inclusion** actions

#### **PILOT PROJECT**

#### **Global Green New Deal**

#### **Inclusive Climate Action**

#### **Pilot City - Warsaw**

#### **Background to pilot**

Warsaw realizes the importance of the climate crisis and the strong processes of environmental degradation that may affect the citizens' life and health. Therefore, we want Warsaw to become a climate neutral city, fair and prosperous for everyone with a modern, resource-efficient economy.

Warsaw is undertaking activities and projects to reduce emissions, improve air quality and improve the quality of life of city citizens, but the city want to strengthen them. By joining C40, Warsaw pledged to achieve climate neutrality by 2050 at the latest and to implement tools to mitigate the effects of climate change.

By implementing the GCCAP, Warsaw is creating a long-term sustainable road map, assessing and prioritising environmental challenges, including water, air, soil and climate change issues. Warsaw also promotes engagement of its citizens in co-creation of urban policies and decision-making, e.g., The Warsaw Climate Panel.

#### **Overall scope of pilot**

In 2021, Warsaw was qualified for the pilot program C40 Global Green New Deal - Inclusive action for the climate. The pilot project aims to tackle two key challenges the city is facing: air quality and energy poverty for low-income groups. The pilot is aimed at ~200 poorest households, and residents of single-family houses. The average monthly income of participants' households is below 438 EUR / 2000 PLN for single person household and below 313 EUR / 1430 PLN per person for multi-person household.

Every building qualified for the pilot is old, energy inefficient, and fired by coal and/or wood. The pilot initiative, with continued financial support from the "Stop smog" programme will cover all activities necessary to reduce levels of energy poverty in participants' households and recommendation for legislators on the local and national level. On the other hand, replacing heat sources with more efficient ones will improve air quality and reduce greenhouse gas emissions. Additionally, the technical and organizational solutions developed in the pilot program will allow for their further dissemination and application in other municipal buildings.

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## 5. GCCAP actions

### 5.14 **Equity and inclusion** actions

#### **Main activities in the project:**

- I. Identification of participants.
- II. Energy audits of the houses
- III. Socio-political analysis of the energy poverty in Warsaw
- IV. Arranging financing of the project
- V. Energy modernization of the houses, replacement of a heating source, installation of RES
- VI. 12 months technical assistance program for participants
- VII. Analysis of the results, conclusions and recommendations.

#### **Expected outcomes and deliverables of pilot**

- Energy audits of 200 houses
- Socio-political analysis of energy poverty in Warsaw
- 200 houses refurbished and energy efficient
- 160 houses coal-free
- 200 households with knowledge of energy efficient building operation

#### **Expected impact of pilot results on city authorities and residents**

Good understanding of the question of energy poverty in Warsaw

- Reduction of CO<sub>2</sub> emissions and other pollutants
- Improvement of the quality of life and health through better air quality, improved thermal comfort and reduced energy bills

## 5. GCCAP actions

### 5.14 Equity and inclusion actions

In addition to the sectoral actions provided in the previous section, two equity and inclusion actions have also been developed, in order to support the effectiveness and improve inclusivity amongst other actions.

**Table 17. GCCAP Equity and inclusion actions summary**

ID	Action	Description	Type	Financial assessment			Estimated carbon emissions reduction*
				Pre-investment (EUR)	CAPEX (EUR)	OPEX (EUR/yr)	
PS1	<u>Education campaigns</u>	Public awareness campaigns about the activities implemented in the GCCAP, including the introduction of new activities as well as expansion and continuation of existing educational campaigns. Campaigns will include raising awareness of residents around energy saving practices and solutions, water consumption and protection of biodiversity, implementation of solutions in the field of blue - green infrastructure.	inclusive action	2.7m			-
PS2	<u>Tackling energy poverty</u>	Tackling energy poverty through systems of fees, subsidies and discounts. It is important to implement inclusive measures so as not to exclude any user groups and to ensure equal opportunities. As part of the measure, it will be important to assess the scale of the existing funds and programs to counter energy poverty.	inclusive action		923.7m		-

\* Estimated carbon reductions were only calculated for actions where this was possible at this stage (e.g. due to not knowing the scale, type and technology of implementation). A detailed assessment will be made at a later stage during e.g. the development of a feasibility study for an action.

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## 5. GCCAP actions

### 5.14 **Equity and inclusion** actions

#### Action implementation

The implementation of the actions will be multi-stage. Firstly, during the implementation process there will be an analysis to understand what education campaigns are needed, which should be integrated into existing campaigns where possible.

The next step would be choosing the form and medium for the campaign. Each campaign should be tailored for the chosen action's purpose.

The action for tackling energy poverty requires recognition of needs and legislative activities of the City Council. The implementation of the program should be monitored, and during the process should be flexibly changed to ensure best solution and support of the users. The implementation of the project will be focus on three elements:

- supplement to electricity bills and discounts in fees;
- investments in thermomodernisation of buildings;
- changing ineffective heating sources and connecting buildings to the municipal heating network.

#### Financing route

- **Pre-investment cost:** 2.7m EUR (12.5m PLN)
- **CAPEX:** 923.7m EUR (4.218bn PLN)
- **OPEX:** N/A

#### Suitable methods of financing:

- Recovery and Resilience Facility;
- B3.4.1 Investments in comprehensive green transformation of cities, 2800 million EUR loans;
- National Fund for Environmental Protection and Water Management, "Stop Smog" Program, 518 million PLN, grants;
- Own funds of the City.

Due to the large scale of the project the National Fund for Environmental Protection and Water Management, "Stop Smog" Program will be an important element for financial support. Financing the project through funding from EU financial programs and Investments in comprehensive green transformation of cities will be an important element.

#### Implementation barriers/challenges

The greatest barrier and challenge to implementing actions that improve equity and inclusion is related to the growth of energy poverty and the need to develop support schemes in this area, reliance on imported fossil fuels, increasing inflation.

#### Conditional requirements

Successful implementation of the actions and overcoming the barriers requires a good recognition of needs, both in the area of education tools and stakeholders and in the area of energy poverty, needs, tools and financial support.

## 5. GCCAP actions

### 5.14 **Equity and inclusion** actions

#### **Roles and partnership**

The Air Protection and Climate Policy Department will be responsible for the implementation in the area of **tackling energy poverty**, with the support of Welfare & Social Projects Department.

In the action related to the implementation of educational campaigns, the role of the leader will be performed by the Centre for Public Communication. Partners and important supporting bodies will be: City Marketing Department, Waste Management Department, Air Protection and Climate Policy Department, Infrastructure Department, Architecture & Spatial Planning Department, Road Traffic Management Department and Environmental Protection Department.

The implementation of educational campaigns is related to other sectors included in the GCCAP, therefore the partners and cooperating bodies will be a broad group: the local community, which should be the main beneficiary of the actions, private and municipal companies and non-governmental organizations.



Photo: City of Warsaw

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## 5. GCCAP actions

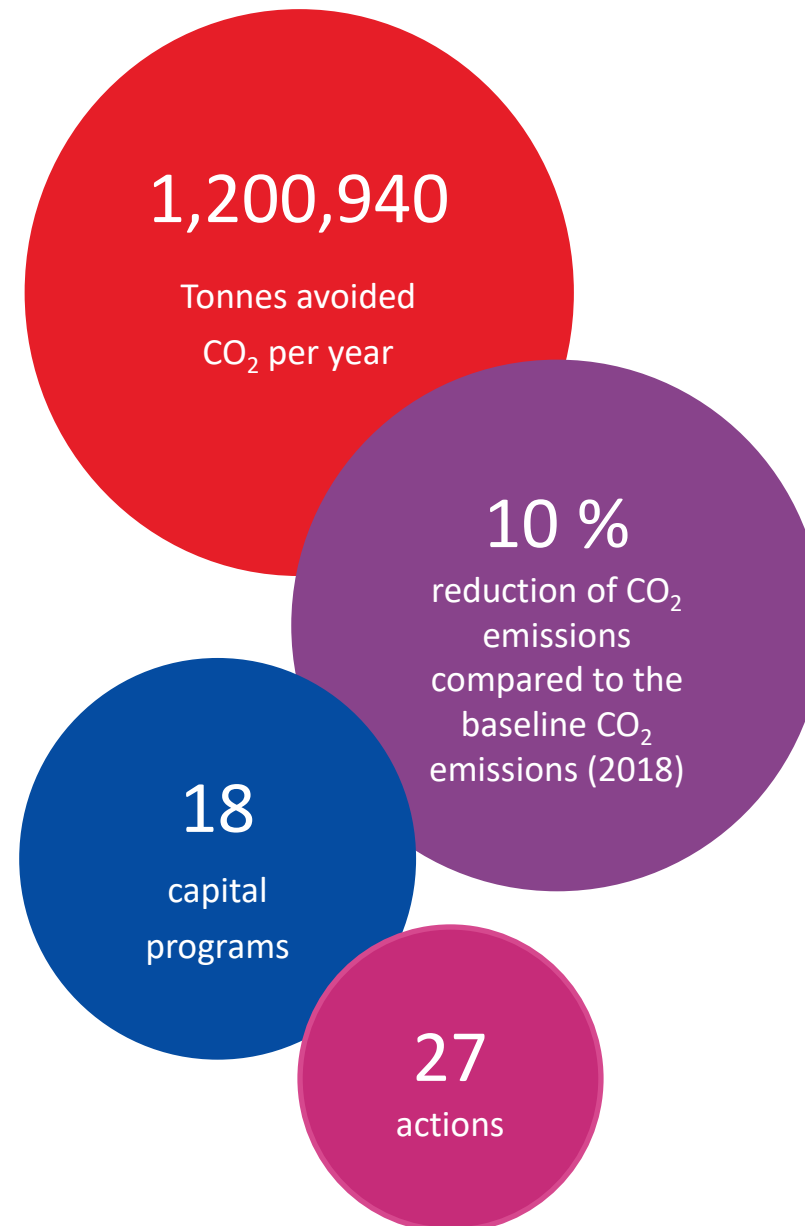
### 5.15 Actions summary

The GCCAP contains 27 actions in total, of which 18 are capital programs. The actions were assigned to the relevant sectors and the total capital costs related to their implementation were estimated. Estimated reductions in carbon emissions and savings in financial resources that may occur after implementation of the assumed measures were also calculated.

Beyond carbon savings, the actions within this Plan will result in a wide range of benefits within Warsaw, including improved air quality, reduced traffic congestion, increased climate resilience and access to high quality green space, and higher levels of social equity within Warsaw.

Co-benefits for each action are provided in more detail in the Action Prospectus, within Appendix A: Green City Action Description.

Together, these actions support the priorities and objectives contained in this document and will help deliver the objectives set out within: #Warsaw2030 Strategy, project of the Sustainable Mobility Program and the Climate Change Adaptation Strategy for the City of Warsaw until 2030 with the perspective to 2050 (Municipal Adaptation Plan).



## 5. GCCAP actions

### 5.15 Actions summary

**Table 18. GCCAP actions statistics**

Sector	Capital programs	Total actions	Total capital cost (EUR)*	Total carbon reductions estimates (tCO <sub>2</sub> /yr)	Estimated savings (EUR/yr)
Energy Infrastructure	3	8	175.863m	597,700	51.238m
Buildings	2	3	1.171bn	476,111	48.4m
Urban Planning and blue-green infrastructure	5	4	264.202m	6,129	-
Transport	6	8	1.775bn	115,400	32.6m
Solid Waste	2	2	50.570m	5,600	817k
Equity and inclusion	-	2	926.4m	-	-
<b>Sum</b>	<b>18</b>	<b>27</b>	<b>4.363bn</b>	<b>1,200,940</b>	<b>133.055m</b>

\* Please note that the total capital cost presented (sum of pre-investment costs and CAPEX) does not show the full cost. For some actions only unit costs are given, e.g., per square meter, kilometer or hectare. It will be possible to present the full estimated costs after the specialized analyzes and research included in the actions have been carried out. They will allow you to identify specific needs.

## 6. Monitoring & reporting





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## 6. Monitoring & reporting

### 6.1 Monitoring & evaluation

The purpose of monitoring and evaluating the progress of implementing the GCCAP is to check whether the actions carried out and the decisions made bring the expected results and what is their impact on the reduction of greenhouse gas emissions. Monitoring reports will be made public to ensure that residents and other stakeholders have access to information and can monitor progress. The following sections describe the framework for monitoring and how to report on progress in implementing the GCCAP.

#### Implementation monitoring

Monitoring the progress of the implementation of the GCCAP should be integrated into the existing processes within the relevant City of Warsaw departments and overseen by the Air Protection and Climate Policy Department to ensure consistency and collaboration.

- **Organisation.** The Air Protection and Climate Policy Department will lead the implementation of the GCCAP and monitor activities of other departments and units indicated as responsible for the actions. The organisational structure of the city is shown in the chart in section 6.2.
- **Units responsible for preparation and implementation.** Appendix A, which describes the GCCAP actions, identifies the units responsible for the action; these departments will be responsible for coordinating work with units supporting the preparation and implementation of actions and supervising their implementation.
- **Budgeting.** Action owners will obtain the budget for the GCCAP actions from external and internal funds. The units will be guided by the cost estimates and financing sources proposed in Appendix A, which presents the description of the GCCAP actions.
- **Reporting & Monitoring.** The action owner (described in action tables) will be responsible for collecting data to monitor progress for each action and report this to the Air Protection and Climate Policy Department periodically (at least annually).
- **Review.** The Protection and Climate Policy Department will periodically (at least annually) review the implementation progress and together with the Departments responsible for the tasks, adjust the assumptions of the scale of actions and implementation time frames. The agreed updated implementation report will be reported to the Mayor.

#### Monitoring the results

- Current monitoring of the results of implementing the GCCAP is very important. It is important to understand to what extent the actions lead to positive changes in the city. Observation of the progress in the implementation of actions will allow to make the necessary adjustments if the observed results are unsatisfactory. Examples of KPIs for each measure can be found in Appendix A, which provides a description of the GCCAP actions.

## 6. Monitoring & reporting

### 6.1 Monitoring & evaluation

#### Monitoring the results cont.

- **Indicator database.** The database containing the pressure-state-response indicators assessments used for the analysis of the current state should be used as a tool to help monitor the results of the implementation of actions. Data for indicators related to an action should be collected on a regular basis.
- **Implementation indicators.** For each action, particular and timed performance indicators should be developed against which progress will be measured.
- **Responsibilities.** There will be a monitoring and reporting coordinator in the Air Protection and Climate Policy Department. Its task will be to supervise data collection and cooperation in the field of monitoring with the relevant departments. Each department will be responsible for monitoring the progress and results of the implementation of actions, including: tracking contacts with stakeholders, collecting and reviewing data and providing information on the above-mentioned a monitoring and reporting coordinator in accordance with the agreed reporting periods.

**Review and evaluation.** The method and indicators for monitoring the impact should be reviewed annually and adjusted if necessary. Actions should also be periodically reviewed in terms of their actual impact, and resources, budgets and actions should be updated as needed. This process may take place without the participation of the Warsaw City Council.

#### Review and evaluation

The city's levels of progress towards its commitment to climate neutrality will be reviewed at least every five years as part of the GCCAP in line with the C40 methodology. It is planned to update the city's emission levels in a two-year cycle. The effectiveness of the reduction scenarios implementation will be monitored in a five-year cycle. There is also a need for regular reporting related to the adaptation process and resilience to climate change. Actions should be verified and adjusted to the progress in achieving the objectives. We recognise the value of evaluating the interactions between mitigation and adaptation actions. For example whether mitigation actions have a positive, negative or neutral impact on adaptation and vice versa. In monitoring plan updates we will consider the interaction between adaptation and mitigation

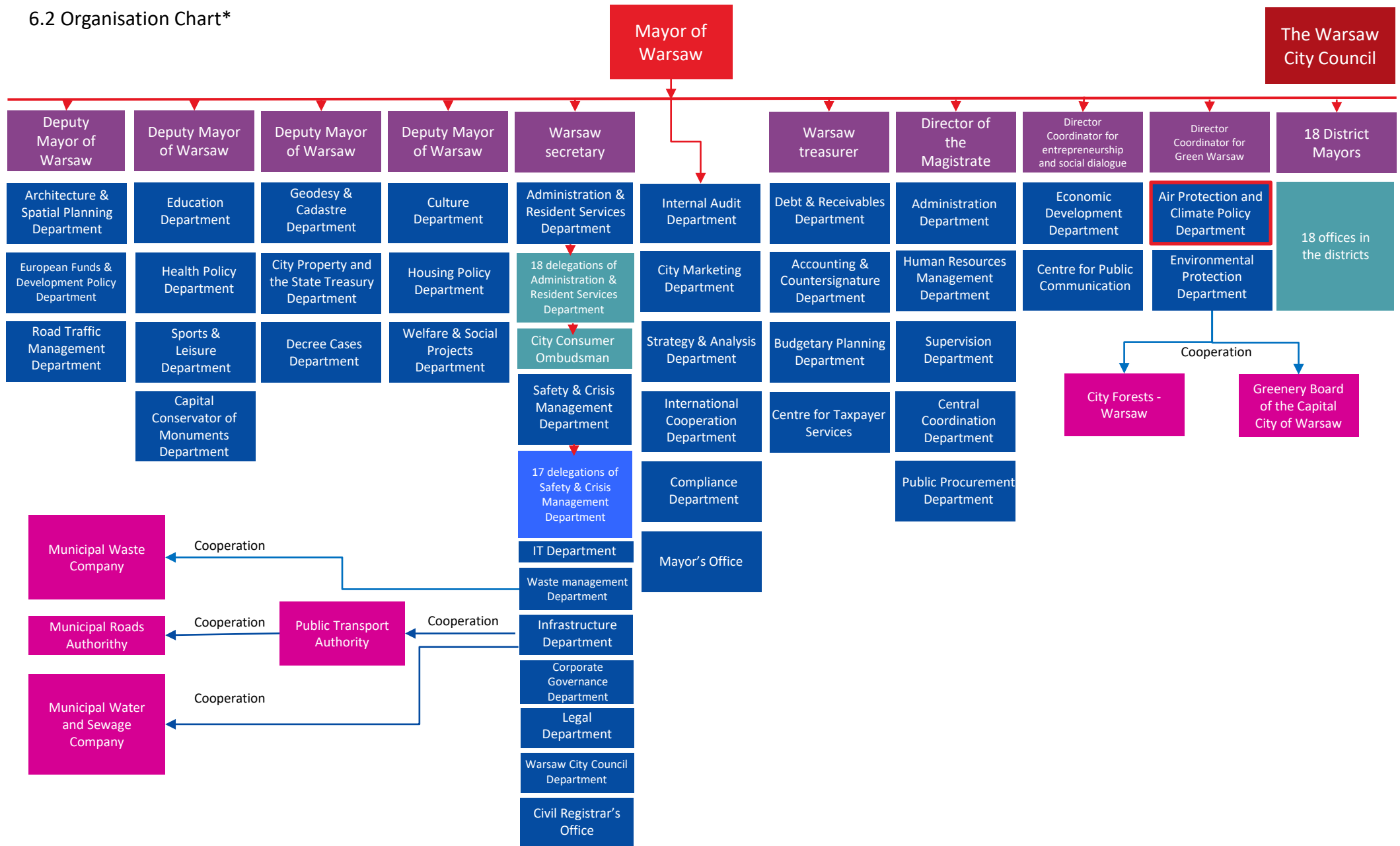
and how to maximise the synergies and minimise the risks. Monitoring of the planned implementation of the Sustainable Energy and Climate Action Plan (SECAP), City Action Plan (CAP) and greenhouse gas emissions in the Global Protocol for Community Scale Emission Inventories (GPC) methodology will be linked.



Photo: City of Warsaw

# 6. Monitoring & reporting

## 6.2 Organisation Chart\*



\*current state as of 04/10/2022 and basis of information available in [the Public Information Bulletin of the Capital City of Warsaw](#).

## 6. Monitoring & reporting

### 6.3 Collecting data to monitor progress on the implementation of actions and the impact of the GCCAP



## 6. Monitoring & reporting

### 6.4 Guidance & example monitoring frameworks

This chapter gives example of monitoring frameworks for the GCCAP action.

The framework provides a guide for measuring both the implementation and the impact of the GCCAP. This uses the Pressure-State-Response indicators of the GCCAP.

**Table 19. Example monitoring framework for Energy action**

ID E2		Indicator(s)	Baseline value	Target within action timeframe
<b>Action</b>	Generation of green Energy by the city within and outside Warsaw's borders.	Is the action delivered on time? Is the action delivered to budget?	-	Deliver action to budget & timeframe agreed by coordination unit.
<b>Implemented the GCCAP objectives</b>	increasing the production of renewable energy in the city	proportion of energy derived from RES in total city energy consumption	power of municipal renewable energy installations – <b>51 MW</b> (2021)	target capacity of municipal RES installations: <ul style="list-style-type: none"> <li>• in 2025 – <b>150 MW</b></li> <li>• in 2030 – <b>750 MW</b></li> </ul>
		share of renewable in total energy consumption	share of renewable in total energy consumption in Warsaw – <b>11%</b> (2019)	all municipal electricity will come from 100% renewable energy sources from 2025  switch from gas-oriented system to renewables by 2050

## 6. Monitoring & reporting

### 6.4 Guidance & example monitoring frameworks

**Table 19. Example monitoring framework for Energy action**

ID E2	Indicator(s)	Indicator(s)	Baseline value	Target within action timeframe
<b>Implemented the GCCAP objectives</b>	promote the phasing out of fossil fuel sources.	heat (fossil fuel) consumption in urban built environment [kWh/m <sup>2</sup> ]	heat (fossil fuel) consumption in urban built environment – <b>325 kWh/m<sup>2</sup> (2019)</b>	Switch all power plants serving the network away from coal to using mainly gas (and some biomass & RDF) by 2035.
	providing the city with heat energy from zero and low-emission sources.	-	-	national electricity grid: by 2050, achieving a zero share of coal in the energy mix, replaced by renewable energy sources

# Appendix A

## Green City Action Description



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## Action list

**Table 20. Green City Action Description**

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Green City Action Description	
<u>Energy Infrastructure</u>	E1 <u>Purchase of green energy for municipal units</u>
	E2 <u>Generation of green Energy by the city within and outside Warsaw's borders</u>
	E3 <u>Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral</u>
	E4 <u>Development of a Municipal Hydrogen Program</u>
	E5 <u>Creation of the Municipal Energy Agency</u>
	E6 <u>Energy strategic partnership</u>
	E7 <u>Creation of a Sustainable Energy Investments Fund</u>
	E8 <u>Outdoor city lighting – LED retrofit</u>
<u>Buildings</u>	B1 <u>Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction</u>
	B2 <u>Program to improve the energy efficiency of municipal buildings with a pilot</u>
	B3 <u>Continued replacement of high-emission heat sources</u>
<u>Urban planning and blue-green infrastructure</u>	R1 <u>Increasing biologically active surfaces and removing impermeable surfaces</u>
	R2 <u>Protection and restoration of valuable green areas</u>
	R3 <u>Preservation &amp; restoration of urban greenery Zakole Wawerskie</u>
	R4 <u>Greening streets</u>

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## Action list

**Table 20. Green City Action Description**

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### Green City Action Description

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<u>Transport</u>	T1	<u>Continued expansion of municipal integrated rail transport</u>
	T2	<u>Convenient and safe zero-emission public transport</u>
	T3	<u>Development of transport interchange and communication hubs</u>
	T4	<u>Support for the development of electromobility</u>
	T5	<u>Research on public transport needs</u>
	T6	<u>Program supporting the implementation of Clean Transport Zones</u>
	IT1	<u>Integrated ticketing for the agglomeration as a part of public transport management</u>
	IT2	<u>Smart local energy systems including vehicle-to-grid and vehicle-to-building</u>
<u>Solid waste</u>	Ok1	<u>Municipal biogas plants development program</u>
	Ok2	<u>HWRC- Household waste recycling centres</u>
<u>Equity and inclusion actions</u>	PS1	<u>Education campaigns</u>
	PS2	<u>Tackling energy poverty</u>

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## Legend of items in action tables

Table 21. Legend of items in action tables

<b>Timescale</b>	The range of years in which the action will be implemented
<b>Type of action</b>	Specification of the type / scope of the actions, divided on: <ul style="list-style-type: none"><li>- Inclusive actions– activities to raise public awareness, increase the city's resilience and support residents and tackle social exclusion;</li><li>- Support actions- long-term, comprehensive and multivariate investment projects;</li><li>- Capital programs– long-term, comprehensive and multivariate, capital-intensive investment project that requires planning and resources;</li><li>- Operational activities- concepts, intra-urban solutions for the implementation of coherent actions of local authorities;</li><li>- regulations - standards that create the potential for resource efficiency and management.</li></ul>
<b>Pre-investment</b>	Expenditure related to pre-investment work, e.g.: development of an investment feasibility study, legal framework study, technical or location analysis, multi-variant concept.
<b>Capital expenditure (CAPEX)</b>	Spending related to the cost of building the facility, implementing the investment.
<b>Operational expenditure (OPEX)</b>	Spending related to preservation of product, business or system.
<b>Action owner</b>	The unit responsible for the preparation, implementation and monitoring of Green City and Climate Action Plan of Warsaw actions.
<b>Bodies supporting the implementation of action</b>	Entities, organisations, or individuals, who participate in the creation of the project (take an active part in its implementation).
<b>Stakeholders</b>	Organizations or individuals, who are directly interested in consulting on the implementation of the action and the results of its implementation.

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## Legend of items in action tables

**Table 21. Legend of items in action tables**

<b>Financing mechanisms</b>	The way in which the company, organization or program receives the funds necessary to continue operating.
<b>Benefits</b>	Benefits related to improving the quality of the environment and life in the city, strengthening the city's climate resilience.
<b>Enabling policies and actions within the GCCAP</b>	How related are the individual solutions implemented within the Green City and Climate Action Plan of Warsaw.
<b>Enabling policies and actions</b>	How related are the policies and actions implemented within the Green City and Climate Action Plan of Warsaw and the existing and operative documents at local, regional, national or international level.
<b>Product indicator</b>	Products, tools and solutions that will be implemented and created within the implementation of the action.
<b>Result indicator</b>	Measurable effects resulting from the implementation of the action.
<b>Smart potential</b>	Possibilities of implementing digital and smart-city oriented technologies within the realization of the action.
<b>Gender and economic inclusion potential</b>	Possibilities of implementing solutions increasing inclusiveness, diversity and accessibility within the realization of the action.

## Short-term objectives– list of abbreviations

Table 22. List of objectives and abbreviations

<b>Short-term objectives of the Green City and Climate Action Plan of Warsaw</b>	
<b>CT1</b>	Development and integration of rail infrastructure
<b>CT2</b>	Investments in pedestrian and bicycle transport
<b>CT3</b>	Investments in zero-emission transport (including green hydrogen)
<b>CT4</b>	Development of a compact and polycentric city
<b>CT5</b>	Intermodal city transport, with interchanges
<b>CE1</b>	Increasing the production of renewable energy in the city (inside and outside the city limits)
<b>CE2</b>	Promoting and supporting the phasing out of fossil fuel sources and the shift towards the use of renewable energy
<b>CE3</b>	Energy and environmentally efficient urban lighting
<b>CE4</b>	Providing the city with heat energy and electricity from zero and low-emission sources
<b>CB1</b>	Thermomodernisation of buildings as the best practice to implement energy-saving and ecological solutions
<b>CB2</b>	Urban standards of ecological construction for new and reconstructed buildings
<b>CB3</b>	Mapping and database of energy consumption management
<b>CO1</b>	Waste prevention and reduction in line with the idea of a circular economy
<b>CO2</b>	Improving the quality of separate collection at source and increasing the amount of separately collected waste
<b>CO3</b>	High level of recovery and recycling of waste
<b>CR1</b>	Implementation of sustainable rainwater management systems
<b>CR2</b>	Protection of valuable habitats, natural corridors and development of blue – green infrastructure in Warsaw (among others, through a municipal land purchase programme)
<b>CR3</b>	Encourage and promote the development of private land in line with municipal good practices

# Energy Infrastructure



## ID E1 Purchase of green energy for municipal units

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Operational action	CE1, CE2, CE4, CB3

### Description

To strive to reduce greenhouse gas emissions, measures should be taken to increase the level of green energy use.

All municipal units (such as Tramwaje Warszawskie Sp. z o. o., Metro Warszawskie Sp. z o. o. and Municipal Water and Sewage Company S.A. - as part of the Warsaw Purchasing Group) and infrastructure: lighting, municipal buildings, transport, traction targets and maintenance of technical facilities should purchase green electricity origin guarantee from 2025 at the latest. Some units already conduct such purchases through the Warsaw Purchasing Group. Other municipal units should be encouraged to purchase guarantees of green energy origin.

An additional area of activity will be adding support for the creation and operation of a new group: the Green Purchasing Group, which will carry out joint purchases of green energy for buildings and municipal units (in the transport sector and water and sewage management). However, until this entity is established, the implementation of the action's objectives will be supported by the Warsaw Purchasing Group. The activity of the Group will ultimately be coordinated and supported by the newly created Establishment of the Municipal Energy Agency.

The use of green energy, along with the implementation of smart local energy systems (e. g. *vehicle-to-grid* or *vehicle-to-building*) will increase the infiltration of renewable energy into the electricity grids.

This action should be supported by a flexible grid monitoring platform that will be equipped with a smart grid, enabling the integration of green electricity supply and consumption in all municipal facilities providing transportation, water, waste, lighting and maintenance services.

### Background and justification

Ultimately, all electricity consumed by units and municipal infrastructure should be produced from renewable energy sources. Purchase of energy with a guarantee of origin from RES is a transitional measure – until Warsaw balances its own RES energy production with the needs of municipalities and municipal infrastructure. The purpose of purchasing “green” energy is to stimulate the energy market in Poland to invest in renewable energy sources, and thus to increase the share of RES use in the country’s energy balance. When purchasing electricity, the Capital City of Warsaw will prefer to choose Polish energy with “green” guarantee of origin.

### The scale of action / notes on the estimate

This action will cover the purchase of guarantees of green energy origin by municipal entities. The estimated total annual electricity consumption of all municipal units is 728 GWh (9,71% of total urban consumption). In 2020, energy production from renewable sources by municipal entities was 51 GWh (44 GWh – biogas; 6 GWh – municipal waste thermal treatment plant; 1 GWh – photovoltaic).

### Cost calculation

- Based on: reference prices of Renewable Energy auctions of the Energy Regulatory Office.
- Operating costs are an expense associated with the purchase of 492 725 MWh of electricity from renewable energy sources, at a price of 320 PLN per 1 MWh.

## ID E1 Purchase of green energy for municipal units

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Operational action	CE1, CE2, CE4, CB3

### Cost calculation cd.

- The demand for the purchase of electricity was defined as the difference between the the city's total electricity demand (728 GWh) and the renewable electricity currently being generated (51 GWh) and the energy contained in the next, respectively dedicated operation (184 GWh). The costs do not include the distribution fee<sup>45</sup>. The estimated cost of savings is the difference between the purchase of electricity from the grid (Average price of electricity in 1Q 2022 according to the Energy Regulatory Office – 466,60 PLN/MWh) and the cost of purchasing green energy.

### Financing mechanisms

- Own funds of municipal enterprises and companies with dominant shareholding of the City of Warsaw,
- Own funds of the City.

### Action owner

- Infrastructure Department

### Bodies supporting the implementation of action

- Air Protection and Climate Policy Department,
- Legal Department.

### Stakeholders

- City companies.

Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
-	-	PLN 157 672 000 EUR 34 525 000
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
PLN 72 233 000 EUR 15 817 000	343 900 tCO <sub>2</sub> /year	2.86%
% of total CO <sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions		
28.64%		

## ID E1 Purchase of green energy for municipal units

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Operational action	CE1, CE2, CE4, CB3

Steps of implementation	Timeline							
	2023	2024	2025	2026	2027	2028	2029	2030
Creation of intra-city regulations for the purchase of green energy for Companies and Departments								
Conducting green energy purchases by the city units								

Product indicator	Result indicator
<ul style="list-style-type: none"> <li>• Number [MWh] of fully certified green energy purchased,</li> <li>• Use of only Energy from renewable sources by the City by 2030,</li> <li>• % of green energy transport services provided,</li> <li>• Number of implemented <i>vehicle-to-grid solutions</i>.</li> </ul>	<ul style="list-style-type: none"> <li>• % change of energy source obtained by municipal units,</li> <li>• % decrease in the emission level of the energy used in the city,</li> <li>• % reduction in greenhouse gas emissions from the energy and transport sectors.</li> </ul>



## ID E1 Purchase of green energy for municipal units

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Operational action	CE1, CE2, CE4, CB3

### Action benefits

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Renewable energy growth / reduction of fossil fuel consumption;</li> <li>• Increased resilience to climate change, including limitation of dependence on water temperature in the Vistula for the energy system;</li> <li>• Change of energy source - increase in the share of green certified energy consumption;</li> <li>• Reduction of greenhouse gas and pollutant emissions;</li> </ul> | <ul style="list-style-type: none"> <li>• An educational campaign on green energy and its importance for the implementation of the idea of a green, sustainable city, and the planet's sustainability;</li> <li>• Encourage residents to use green energy solutions and raise awareness of the benefits of using green energy.</li> </ul> |
|--|--|

### Enabling policies and actions within the GCCAP

- E2 Generation of green Energy by the city within and outside Warsaw's borders,
- E5 Creation of the Municipal Energy Agency,
- E3 Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral.

### Enabling policies and actions

- Poland's energy policy until 2040,
- Warsaw Purchasing Group,
- Environmental protection program for the Capital City of Warsaw for the years 2021-2024.

## ID E1 Purchase of green energy for municipal units

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Operational action	CE1, CE2, CE4, CB3
<b>Smart potential</b>		<b>Gender and economic inclusion potential</b>
<ul style="list-style-type: none"> <li>• Development of the energy purchase platform for multiple municipal buyers based on the previous data and experience,</li> <li>• Potential further development:               <ul style="list-style-type: none"> <li>• Implementation of renewable energy solutions in the city and outside the city limits,</li> <li>• Potential to use smart controls, storage and demand-side energy management to reduce the cost of energy and maximise the use of self-generated renewable energy.</li> </ul> </li> </ul>		<ul style="list-style-type: none"> <li>• Inclusiveness of the recruitment process for a new position in a newly established unit (Green Purchasing Group),</li> <li>• Not transferring the increase in the cost of certified green energy to the end-users of municipal infrastructure.</li> </ul>

## ID E2 Generation of green Energy by the city within and outside Warsaw's borders

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CE1, CE2, CE4, CB3

### Description

The development of investments in renewable energy sources in Warsaw will run in five directions:

- photovoltaics,
- wind,
- biogas,
- green hydrogen,
- low-temperature geothermal energy.

Photovoltaics - according to the recommendation of the Warsaw Climate Panel, by 2030, photovoltaic panels should be installed on roofs and facades of municipal buildings and on municipal transport infrastructure (bus and tram depots and terminals, parkings (including P&R)). Implementation of these activities should take place after verification of the feasibility and profitability of installing photovoltaic panels at these locations. Currently, photovoltaics is installed in more than 130 urban locations. It is aimed at the total generation capacity of photovoltaic panels to be 9.3 MW in 2022 (the Municipal Water and Sewage Company in the Capital City of Warsaw S.A. plans to increase its photovoltaic generation capacity to 6.7 MW).

In addition to city buildings, transport and parking infrastructure, another direction is to create large photovoltaic farms, which can be built on municipal plots and plots belonging to municipal companies (Municipal Waste Management in Capital City of Warsaw sp. z o.o., Municipal Water and Sewage Company of the Capital City of Warsaw S.A.), also including areas located outside the city boundaries.

Wind power plant - investing in own wind energy sources is crucial as this energy covers the demand when it is not possible to obtain energy from photovoltaics. It is important to invest in installing low power wind farms, for example on the roofs of buildings. Due to the lack of land for the location of wind farms of high power in Warsaw, as well as legal restrictions (which may change, which in such a case would extend the possibilities of installing wind farms) when locating such investments in built-up areas (the so-called 10H Act), partnership and cooperation with other local governments is necessary. Partnerships with private investors who invest in RES with the possibility of selling energy to the City of Warsaw are also possible

Biogas - Currently the production of renewable electricity from biogas obtained from wastewater treatment allows the city to generate a significant amount of renewable energy (44 MW).

Warsaw has the potential to increase this production and further investments in the production of renewable electricity and heat from biogas obtained from the surplus of bio municipal waste fraction that will not be processed into compost. Converting bio-waste into compost reduces the need for peat use.

Green hydrogen - will be key to decarbonising transport in Warsaw. Warsaw should consider the creation of a hydrogen hub, i.e., an infrastructure for the production of green hydrogen, a network of hydrogen charging stations and the development of the city's transport fleet based on this fuel.

The development of low-temperature geothermal energy will take place by supporting the installation of heat pumps in new and modernised municipal and private buildings, as part of the implementation of Action B2 Energy efficiency improvement program for municipal buildings with a pilot program.

An additional energy source will be the expanded of waste incineration plant (described in a separate action).

The Municipal Energy Agency (described in action E5) will be a key inclusive action, enabling the implementation of both investment proposals of E2 action.

## ID E2 Generation of green Energy by the city within and outside Warsaw's borders

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CE1, CE2, CE4, CB3

### Description cont.

The agency will support implementation of the Infrastructure Department initiative related to building a system of urban "energy islands". The "islands" will be created in small areas and will consist of several urban units powered by their own energy source. Thanks to this, units in such areas can become energy independent.

The Urban Photovoltaic Development Program for 2022-2030 is the implementation of the recommendations of the Warsaw Climate Panel: "Installing photovoltaic panels on the roofs of all buildings belonging to the City by 2030, including P + R car parks and city depots".

Department of Air Protection and Climate Policy, which is responsible for planning climate policy, reducing the city's CO<sub>2</sub> emissions and providing subsidies for renewable energy sources, will play an important role in implementation of this action.

The action should be implemented with the Department of Integrated Territorial Investments of the Department of European Funds and Development Policy in metropolitan cooperation.

The action implementation should be supported by grid management system upgrade to integrate large quantity of renewable Energy.

### Background and justification

The cost of electricity purchased for the City's needs in 2020 amounted to over 327 mln PLN. The cost of greenhouse gas emission allowances in the European Union is constantly rising, and the currently deepening energy crisis linked to the reduced supply of coal and gas on European markets is causing record increases in electricity prices. The fact that as much as 70% of electricity generation in Poland is based on burning coal will mean that electricity prices will rise in the coming years, and hence the City's expenditure will increase. Thus, the best solution, not only in the context of reducing greenhouse gas emissions but also reducing the City's expenses, is to invest directly in generating energy from renewable sources.

In Warsaw, the possibilities of using some renewable energy resources on a large scale are limited due to the intensive development (e. g. wind energy). The energy partnership with a private company and neighbouring municipalities can provide a mechanism for a city's transition to low carbon energy sources in a more cost-effective way than trying to build renewable energy generation facilities in inappropriate locations.

### The scale of action / notes on the estimate

In the framework of the Urban Photovoltaic Development Program for 2022-2030 it is planned to carry out photovoltaic investments on municipal buildings (schools, kindergartens, community centres, social welfare centres, hospitals, clinics, libraries and municipal residential buildings)<sup>46</sup>. Before starting the investment, it is recommended to perform a technical analysis and feasibility study of the planned actions. Where the structure of the indicated buildings does not allow to install photovoltaic installations, it should be considered to implement green roofs.

It is also assumed that a wind farm will be built outside the city limits or a photovoltaic farm in the city or also outside its borders, depending on the results of the analyzes.

### Cost calculation

- Air Protection and Climate Policy Department (PK), Cost estimates presented by EBRD, Wind Measurement International, Report "Impact of weighted average cost of capital, capital expenditure, and other parameters on future utility-scale PV levelised cost of electricity", Energy Regulatory Office, City Council of Warsaw, Arup benchmarks.

## ID E2 Generation of green Energy by the city within and outside Warsaw's borders

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CE1, CE2, CE4, CB3

### Cost calculation cont.

- The capital expenditure of the Municipal Photovoltaic Development Program for 2022-2030 is the cost of installing photovoltaic panels on 1,000 municipal buildings in the city of Warsaw, assuming the average cost per building of 250,000 PLN. At the beginning of the investment, a technical analysis of the possibility of installing photovoltaic panels on the above-mentioned municipal buildings should be carried out.
- The amount of capital expenditure on the construction of a wind farm with a total capacity of at least 35 MW outside the city limits is the result of multiplying the assumed power of the wind farm by the average price of building such a wind farm - 6.85 million PLN (1.5 million EUR) per 1 MW.
- The cost of building a photovoltaic farm with a total capacity of at least 35 MW in the city or outside its borders is the result of multiplying the assumed farm capacity by the average price of building such a farm - 3.2 million PLN (700 thousand EUR) per 1 MW<sup>47</sup>.

- The operating costs of a wind farm are mostly wind turbine maintenance costs, which is a fixed annual amount for regular maintenance of around 2% of the capital expenditure.
- The operating costs of the Program and the PV farm include PV plant maintenance, land / building lease, insurance, asset management costs, grid charges or balancing. In this case, an average cost of € 0.046 / kW / year was assumed, i.e., 1% of the average current investment cost<sup>48</sup>.
- The estimated savings are the difference between the purchase of electricity from the grid (average price of electricity in Q1 2022 according to URE – 466,6 PLN) and the annual cost of maintaining the photovoltaic farm.
- An additional benefit for the city are financial savings - in the years 2022-2030, due to the panels, they will amount to a total of more than 70 million PLN (based on the assumptions of the program presented by the City).

### Financing mechanisms

- Recovery and Resilience Facility
  - B3.4.1. Investments for comprehensive green transformation of cities, 2800 million EUR loans;
  - B2.2.2 Renewable energy community investments (including local governments), 97 million EUR in grants.
- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.2. Promotion of renewable energy
    - CODE 47. Wind renewable energy, 5.9 million EUR grants for more developed regions;
    - CODE 48. Solar renewable energy, 14.7 million EUR grants for more developed regions;
    - CODE 49. Renewable energy biomass, 5.3 million EUR grants for more developed regions;
    - CODE 50. Renewable energy biomass with high level of greenhouse gas reduction, 1 million EUR for more developed regions;

## ID E2 Generation of green Energy by the city within and outside Warsaw's borders

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CE1, CE2, CE4, CB3

### Financing mechanisms cont.

- CODE 52. Other RES (including geothermal), 1.2 million EUR for more developed regions;
- CODE 53. Intelligent energy systems and related storage, 7.1 million EUR for more developed regions;
- Own funds of companies investing in RES in the Energy Service Company or public-private partnership formula
- National Fund for Environmental Protection and Water Management, Energy Plus program, preferential loans
- Loans, credits, green bonds
- Own funds of the City
- Health Policy Department
- Housing Policy Department
- Districts of the capital city of Warsaw
- Public Transport Authority
- Municipal Water and Sewage Company
- Municipal Cleaning Company
- Tramwaje Warszawskie Sp. z o.o.
- Miejskie Zakłady Autobusowe Sp. z o.o.
- Municipal Roads Authority

### Stakeholders

- Municipalities
- Private and municipal enterprises

### Action owner

- **Infrastructure Department**

### Bodies supporting the implementation of action

- Air Protection and Climate Policy Department
- European Funds and Development Policy Department
- Education Department
- Aid and Social Projects Department

## ID E2 Generation of green Energy by the city within and outside Warsaw's borders

Timescale			Type of action			Short-term objectives of the GCCAP		
2023–2029			Capital program			CE1, CE2, CE4, CB3		
Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)	Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year			
Feasibility study for the construction of a photovoltaic farm: <ul style="list-style-type: none"> <li>• PLN 1 200 000</li> <li>• EUR 263 000</li> </ul> Feasibility study for the construction of a wind farm: <ul style="list-style-type: none"> <li>• PLN 1 500 000</li> <li>• EUR 328 500</li> </ul>	Urban Photovoltaic Development program 2022-2030: <ul style="list-style-type: none"> <li>• PLN 250 000 000</li> <li>• EUR 54 700 000</li> </ul> Implementation of a wind farm outside of the city: <ul style="list-style-type: none"> <li>• PLN 240 000 000</li> <li>• EUR 52 500 000</li> </ul> Implementation of a solar farm outside of the city: <ul style="list-style-type: none"> <li>• PLN 112 000 000</li> <li>• EUR 24 500 000</li> </ul>	Urban Photovoltaics Development Program 2022-2030: <ul style="list-style-type: none"> <li>• PLN 2 500 000</li> <li>• EUR 547 000</li> </ul> Wind farm: <ul style="list-style-type: none"> <li>• PLN 4 800 000</li> <li>• EUR 1 050 000</li> </ul> Photovoltaic Panel Farm: <ul style="list-style-type: none"> <li>• PLN 1 100 000</li> <li>• EUR 245 000</li> </ul>	Municipal Photovoltaic Development Program 2022- 2030: <ul style="list-style-type: none"> <li>• PLN 70 000 000</li> <li>• EUR 15 300 000</li> </ul> The wind farm: <ul style="list-style-type: none"> <li>• PLN 11 500 000</li> <li>• EUR 2 500 000</li> </ul> The photovoltaic farm: <ul style="list-style-type: none"> <li>• PLN 15 200 000</li> <li>• EUR 3 300 000</li> </ul>	Municipal Photovoltaic Development Program 2022-2030: 87 000 tCO <sub>2</sub> /year  Wind farm: 55 900 tCO <sub>2</sub> /year  Photovoltaic farm: 28 200 tCO <sub>2</sub> /year	Municipal Photovoltaic Development Program 2022-2030: 0.72%  Wind farm: 0.47%  Photovoltaic farm: 0.23%			
<b>% of total CO<sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions</b>								
Total: 14.22% <ul style="list-style-type: none"> <li>• Urban photovoltaic development program 2022-2030: 7.24%</li> <li>• Wind farm: 4.65%</li> <li>• Photovoltaic farm: 2.35%</li> </ul>								

## ID E2 Generation of green Energy by the city within and outside Warsaw's borders

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CE1, CE2, CE4, CB3

Steps of implementation	Timeline						
	2023	2024	2025	2026	2027	2028	2029
Creating local and supra-local partnerships for the implementation of investment activities							
Analysis of investment opportunities and locations with individual investment partners							
Investments in renewable Energy installations							
Work on municipal initiatives to facilitate the implementation of renewable energy projects							

Product indicator	Result indicator
<ul style="list-style-type: none"> <li>Power of municipal renewable energy installations,</li> <li>Implementation of the installation of photovoltaic panels on 1000 buildings by 2030,</li> <li>Implementation by the City of at least one photovoltaic farm and wind farm (outside the city limits) by 2030.</li> </ul>	<ul style="list-style-type: none"> <li>Reaching the target capacity of municipal RES installations of 150 MW in 2025, and 750 MW in 2030</li> </ul>



## ID E2 Generation of green Energy by the city within and outside Warsaw's borders

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CE1, CE2, CE4, CB3

### Action benefits

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>• Reduction of greenhouse gas emissions,</li> <li>• Renewable energy growth / reduction of fossil fuels,</li> <li>• Increased resilience to climate change,</li> <li>• Change of energy source - increase in the share of green certified energy consumption,</li> </ul> | <ul style="list-style-type: none"> <li>• Reduction of greenhouse gas and pollutant emissions,</li> <li>• Reduction of costs for the City budget,</li> <li>• Improving the quality of life of residents resulting from the reduction of air pollution.</li> </ul> |
|---|--|

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- E5 Creation of the Municipal Energy Agency,
- E3 Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral,
- E6 Energy strategic partnership,
- E1 Purchase of green electricity for municipal units.

### Enabling policies and actions

- Poland's energy policy until 2040,
- Warsaw Climate Panel (recommendations: Analysis of local renewable energy generation opportunities by potential prosumers and energy cooperatives; installation by 2030 of photovoltaic panels on the roofs of all buildings of the City, including P + R parking lots and city depots, if there is a technical and architectural possibility and maintenance of the installation).

## ID E2 Generation of green Energy by the city within and outside Warsaw's borders

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CE1, CE2, CE4, CB3

### Smart potential

- Implementing renewable energy solutions in the city and broad,
- Designing and installing new generation communication systems that support the implementation of renewable energy solutions in the city and abroad (such as LoRaWan, NBloT),
- Establishing an Energy Management System (EMS) to best design and integrate various RE resources,
- The potential to use smart controls, storage and demand-side energy management to reduce energy cost and maximize self-generated renewable energy use.
- Smart systems supporting the increase in the maturity of the City's Energy Management (alongside EMS); SCADA (Supervisory Control And Data Acquisition) , BMS (Building Management System), Smart Meter, HEMS (Home Energy Management System),
- Potential for analytics system investments with the private sector and academia (big data, data mining and machine learning)

### Gender and economic inclusion potential

- Enabling, through own production of renewable energy, the transfer of energy (free of charge or on favourable conditions for heating and supplying heat pumps or other electric heating) for people suffering from energy poverty;
- Ensuring a balanced participation of representatives of both genders in the process of planning and implementing innovative solutions improving energy efficiency - in expert and decision-making positions, as well as at the stage of creating analyses of the implementation potential of such solutions.
- Providing equal access for women to green jobs - i.e., jobs related to the city's renewable energy production.

## ID E3 Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CE1, CE2, CE4, CB3

### Description

Achieving climate neutrality for the Municipal Water and Sewerage Company of the Capital City of Warsaw S.A. will comprise a number of activities including:

- implementation of circular economy principles in the areas of water and wastewater,
- further development of renewable energy production by increasing the amount of energy produced from biogas, including expansion of the biogas part of the wastewater treatment plant - preparation of the feasibility and performance needs assessment,
- development of technologies for the recovery and use of heat from sewage and sludge and its re-development,
- improving the functioning of the sewage sludge management system,
- utilizing wastewater as a heat source for heat pumps,
- use of photovoltaic panels on the premises of subsequent plants,
- considering the possibility of building wind farms on the Company's premises,
- further modernisation of the existing infrastructure and management system.

### Background and justification

The Municipal Water and Sewerage Company has many opportunities to improve the efficiency of the use of resources and various by-products. The measure helps the company to find additional innovative solutions to improve energy efficiency. The company is already implementing some in the field of circular economy and RES and will continue to expand them in its facilities. The city and the company focuses on actions improving energy efficiency in both water supply and sewage services. The project of long-term modernisation and expansion of the water and sewage infrastructure in Warsaw is being implemented, under the name of "Water supply and sewage treatment in Warsaw", under which actions as: the construction and modernisation of the water supply and sewage network, pumping station and water treatment station, construction and implementation of a central control system for the sewage network, and implementation of an effective sludge management system. In order to establish relations with the private sector, a beneficial solution for MPWiK would be the construction of a photovoltaic farm under the public-private partnership model.

### The scale of action / notes on the estimate

Annual electricity consumption by the company was 184,275 MWh in 2019.<sup>49</sup> (currently over 20% of the entire company's energy needs are met from renewable energy sources). The Municipal Water and Sewerage Company mainly uses biogas produced in the fermentation of sewage sludge to generate electricity and heat.

The "Czajka" wastewater treatment plant, which is also a small power plant, produces approximately 40,000 MWh of electricity and similar amounts of thermal energy per year, which are entirely used by the plant.<sup>50</sup> The company has plans to modernise this treatment plant and increase biogas production by more than 10,000 m<sup>3</sup>/d through the installation of 4 new digesters. The implementation of the presented investments will depend on the result of the assessment of the feasibility of these investments. The remaining electricity demand will be met by purchasing certified electricity from renewable sources.

## ID E3 Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CE1, CE2, CE4, CB3

### Cost calculation

- Based on: Cost estimates presented by EBRD, NS Energy Business - construction of a biogas plant in Bergheim-Paffendorf, Germany, European Commission - Sewage Treatment Plant Gdańsk-East, Birch Solutions, Enerad.pl portal, Energy Regulatory Office, Municipal Water and Sewerage Company.
- The estimated cost of 1 MW of the installation capacity of photovoltaic panels is approx. 3.2 million PLN (700 thousand EUR). It is planned to build a photovoltaic farm with a total minimum capacity of 5 MW. The costs of modernising the existing "Czajka" Wastewater Treatment Plant were estimated on the basis of the tender for the modernisation of the sludge and biogas part of the Starachowice wastewater treatment plant, which consisted of the installation of two digesters with a capacity of 2 500 m<sup>3</sup> each, together with the obligatory civil works.

- The assumed generating capacity of the photovoltaic farm was determined on the basis of the total available area of land and roofs of Municipal Water and Sewerage Company (7,56 ha) for the implementation of the installation of photovoltaic panels. It was assumed that 1.5 ha of area is needed for the implementation of a 1 MW photovoltaic farm. The data on operating costs (OPEX) available on the market are maintenance of the photovoltaic installation, the cost of land lease, insurance, asset management costs, network charges and balancing. In this case, an average OPEX of EUR 0.046/kW/year was adopted, i. e. 1% of the current investment cost.<sup>51</sup>
- Investment expenditures for the modernization of the "Czajka" wastewater treatment plant include the cost of installing 4 new digesters with a total capacity of 10 000 m<sup>3</sup>/d including the civil works that accompany these activities. The average cost per 1 m<sup>3</sup>/d was estimated as 5,12,000 PLN. These costs do not include the financial outlay for the purchase of biogas preparation and storage facilities and cogeneration units.

An estimate of the value of these costs will only be possible at a later stage of investment planning. The modernisation will allow the generation of 51,300 MWh of electricity per year. The operating cost of a biogas plant is 2% of the capital cost<sup>52</sup>. The operating cost is the running cost of maintaining the plant. They include costs such as staff recruitment and payment, maintenance, transportation and other general operating expenses. They also include the cost of the input material, which may not be a direct payment for the material but includes other costs such as handling and transportation.

The estimated operating costs also include the cost of purchasing certified green electricity, the demand of which has been estimated at approximately 91 080 MWh (reference price of the Energy Regulatory Office – 320 PLN/MWh). The estimated cost of savings is the difference between the purchase of electricity from the grid (Average price of electricity in Q1 2022 according to the ERO – PLN 466.6) and the operating costs of a photovoltaic farm, biogas plant and the purchase of green energy<sup>53</sup>.

## ID E3 Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CE1, CE2, CE4, CB3

### Financing mechanisms

- Recovery and Resilience Facility
  - Investments for comprehensive green transformation of cities, 2800 million EUR loans,
- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.2: Promoting renewable energy,
    - CODE 52. Other types of RES (including geothermal energy), 1.2 million EUR for more developed regions,
- National Fund for Environmental Protection and Water Management, Energy Plus program, preferential loans,
- Investment loans, credits, green bonds,
- Own funds of Miejskie Przedsiębiorstwo Wodociągów i Kanalizacji w m.st. Warszawie S.A.,
- Own funds of the City,
- Intersectoral cooperation.

### Action owner

- Municipal Water and Sewerage Company**

### Bodies supporting the implementation of action

- Infrastructure Department

### Stakeholders

- Corporate Governance Department
- Economic Development Department

Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
-	Cost of installing photovoltaic panels <ul style="list-style-type: none"> <li>PLN 16 100 000</li> <li>EUR 3 500 000</li> </ul> Modernisation of the sludge and biogas section of the „Czajka” wastewater treatment plant: <ul style="list-style-type: none"> <li>PLN 51 200 000</li> <li>EUR 11 200 000</li> </ul>	The cost of purchasing the remaining 91 080 MWh of certified green electricity <ul style="list-style-type: none"> <li>PLN 29 145 000</li> <li>EUR 6 380 000</li> </ul> For solar panels <ul style="list-style-type: none"> <li>PLN 161 000</li> <li>EUR 98 000</li> </ul> For biogas plants <ul style="list-style-type: none"> <li>PLN 1 020 000</li> <li>EUR 224 000</li> </ul>
<b>Estimated savings</b>	<b>Estimated CO<sub>2</sub> emission reduction</b>	<b>% reduction in GHG emissions compared to the 2018 inventory year</b>
PLN 38 456 000 EUR 8 421 000	ok. 46 800 tCO <sub>2</sub> /year	0.39%
<b>% of total CO<sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions</b>		
3.90%		

## ID E3 Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CE1, CE2, CE4, CB3

Action benefits	Timeline							
	2023	2024	2025	2026	2027	2028	2029	2030
Possibility analysis and project implementation plan for energy neutrality								
Investments in photovoltaics								
Development of the biogas part of the sewage treatment plant- subject to positive assessment of the feasibility of the investment								

Product indicator	Result indicator
<ul style="list-style-type: none"> <li>• % of the change in the source of energy obtained by Municipal Water and Sewerage Company in the capital city of Warsaw S.A.,</li> <li>• % of energy produced from biogas,</li> <li>• number of new technologies for the use (recovery) of wastewater heat,</li> <li>• % of the use of treated wastewater as a heat source for heat pumps,</li> <li>• number of new photovoltaic panels installed on the territory of subsequent plants belonging to Municipal Water and Sewerage Company in the capital city of Warsaw S.A.,</li> <li>• Being fully climate neutral by generating its own electricity from renewable sources or buying energy with green certificates by 2030.</li> </ul>	<ul style="list-style-type: none"> <li>• % of reduction in greenhouse gas emissions from the water and sewage sector,</li> <li>• % of decrease in the company's Opex costs incurred for the purchase and production of energy,</li> <li>• % of reduction in energy demand.</li> </ul>

## **ID E3 Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral**

<b>Timescale</b>	<b>Type of action</b>	<b>Short-term objectives of the GCCAP</b>
2023–2030	Capital program	CE1, CE2, CE4, CB3

### **Action benefits**

- Increased resilience to climate change,
- Renewable energy growth / reduction of fossil fuels,
- Reduced greenhouse gas emissions,
- Reduction in energy demand,
- Reduced energy consumption of water services,
- Reduce a company's electricity bill, which can translate into lower costs for consumers.

### **Enabling actions within the Green City and Climate Action Plan of Warsaw**

- Ok1 Biogas plants development program,
- E2 Generation of green Energy by the city within and outside Warsaw's borders.

### **Enabling policies and actions**

- Poland's energy policy until 2040,
- Multiannual Development and Modernisation Plan of Water Supply and Sewerage Equipment Municipal Water and Sewerage Company in the capital city of Warsaw for the years 2022-2030,
- Policy for the development of the water and sewage system in Warsaw until 2025.

## ID E3 Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CE1, CE2, CE4, CB3

Smart potential	Gender and economic inclusion potential
<ul style="list-style-type: none"> <li>Increased innovation and competitiveness in the water and sewage sector: support and development of smart/digital solutions that Municipal Water and Sewerage Company in the capital city of Warsaw S.A. implements, such as: expansion of the GIS system and models of the water supply and sewage network in the city, implementation of an intelligent sewage network control system,</li> <li>effective use of external technologies that detect the location and amount of losses and leaks in lines without the need to update the grid management system especially; sensors with RF-acoustic technology, prediction with artificial intelligence, analysis with noise loggers, expansion of SCADA and IoT-WAN communications),</li> <li>Implementation of the Central Technology Database - an analytical and information tool that collects measurement data in a centralized manner,</li> <li>Implementation of a new version of the remote reading system for water meters,</li> <li>Implementation of an e-learning platform.</li> </ul>	<ul style="list-style-type: none"> <li>Ensuring a balanced participation of representatives of both genders in the process of supporting Municipal Water and Sewerage Company in the capital city of Warsaw S.A. in finding more innovative solutions improving energy efficiency - in expert and decision-making positions.</li> <li>Ensuring equal access for women to green jobs - i.e., those related to the implementation of changes aimed at achieving zero-emission Municipal Water and Sewerage Company in the capital city of Warsaw S.A.</li> </ul>



## ID E4 Development of a Municipal Hydrogen Program

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2025	Inclusive actions	CE1, CE2, CE4

### Description

Development of a feasibility study and investment program in hydrogen energy sources in the city for the coming years, with the Warsaw Hydrogen Initiative. Hydrogen has been identified as a potential low-carbon energy vector for industry and transportation. Hydrogen shows great promise in applications that have few viable alternatives, such as high-temperature processing and heavy goods transport.

The city needs detailed research into potential areas of hydrogen use that are viable and applicable to urban infrastructure. The hydrogen program would enable the identification of potential implementation areas, planning the next steps, selecting pilot projects and long-term development programs on the use of hydrogen in energy and transport.

These programmes would focus on the feasibility of innovative production, storage, use and transport of hydrogen over a network. At the same time, the activities indicated here, would contribute to the development of competences and the expansion of human resources for the hydrogen economy.

### Background and justification

Hydrogen is potentially a valuable part of the future low-carbon energy system, but implementation pathways are currently uncertain. Therefore, more research is needed before concrete development projects can be confidently proposed. It is particularly important to explore the possibilities of producing green hydrogen in urban areas and for urban infrastructure.

### The scale of action / notes on the estimate

Pre-investment expenditure relates to the costs of preparing the assumptions and analyses needed for the Municipal Green Hydrogen Programme and the costs of developing a study of the legal framework for its implementation in the city.

### Cost calculation

- Based on the benchmark of market offers, many years of experience and extensive knowledge in the implementation of similar projects by Arup.
- The amount of pre-investment costs is the cost of developing a feasibility study (PLN 500,000) and developing a green hydrogen strategy (PLN 350,000).

### Financing mechanisms

- Recovery and Resilience Facility
  - B2.1.1. Investments in hydrogen technologies, production, storage and transportation of hydrogen, 897 million EUR grant,
- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.2: Promoting renewable energy,
- CODE 52. Other types of RES (including geothermal energy), 1.2 million EUR for more developed regions,
- Investment loans, credits, green bonds,
- Own funds of the City.

## ID E4 Development of a Municipal Hydrogen Program

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2025	Inclusive actions	CE1, CE2, CE4

Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
PLN 850 000	-	-
EUR 186 000		
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
-	-	-
% of total CO <sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions		
-		

### Action owner

- Infrastructure Department

### Bodies supporting the implementation of action

- Air Protection and Climate Policy Department
- Public Transport Authority

### Stakeholders

- Private enterprises
- Municipal Water and Sewerage Company (MPWiK in the Capital City of Warsaw S.A.)
- Municipal Cleaning Company in the Capital City of Warsaw

## ID E4 Development of a Municipal Hydrogen Program

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2025	Inclusive actions	CE1, CE2, CE4

Steps of implementation	Timeline		
	2023	2024	2025
Tender for a feasibility study and investment program for hydrogen energy sources in the city for the coming years			
Execution of a feasibility study and investment program for hydrogen energy sources in the city for the coming years			
Establishing contacts and talks with the private sector			

Product indicator	Result indicator
<ul style="list-style-type: none"> <li>Study and investment program for hydrogen energy sources in the city by 2025</li> </ul>	<ul style="list-style-type: none"> <li>Number of pilot projects implementing the hydrogen strategy in the city</li> </ul>

## ID E4 Development of a Municipal Hydrogen Program

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2025	Inclusive actions	CE1, CE2, CE4

### Action benefits

- Improving the practice of managing city development,
- Conducting research and development is a pre-requisite to the development of appropriate investments and an increase in the competitiveness and innovation of the implemented solutions,
- The creation of a program will allow for an analysis of the needs and orientation of the city's future activities, which in turn will enable the systematization of tasks that must be performed for them to be implemented,
- Increase in innovation and competitiveness of the city compared to the rest of the country, enabling to be a leader in respect of the development of a hydrogen program, presenting solutions for other cities, as well as creating an attractive place for the development of companies.

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- E2 Generation of green Energy by the city within and outside Warsaw's borders
- E6 Energy strategic partnership

### Enabling policies and actions

- Poland's energy policy until 2040
- Polish Hydrogen Strategy until 2030 with a perspective until 2040

### Smart potential

- The action can indirectly contribute to the implementation of new hydrogen technologies in the energy infrastructure sector of the city,
- Defining support programs for start-ups working on clean energy systems (such as hydrogen technology) in the city,
- Development programs for companies working on hydrogen fuel in existing and/or newly established R&D (Research&Development) centers in the city, such as trainings, allocation areas of experiences,
- Open data platform/discussion forum to publish data on the development of hydrogen technology.

### Gender and economic inclusion potential

- The hydrogen program should include an analysis of the possibilities of using green hydrogen to compensate for the opportunities and counteracting energy poverty.

## ID E5 Creation of the Municipal Energy Agency

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Enabling action	CE1, CE2, CE4

### Description

Establishing a municipal organizational unit (municipal company) that will gather in one place the competencies currently in the Infrastructure Department and Air Protection and Climate Policy Department of the capital city of Warsaw S.A., as well as companies operating in the energy sector. The unit will be responsible for implementing energy efficiency programs for both private and municipal buildings; implementation of strategy, policy and plans documents in the areas specified in the adopted by the City. It will work to implement cost-effective energy saving measures for both residents and businesses.

The agency will be the executive unit implementing city strategies and plans of achieving climate neutrality in the energy sector, with particular emphasis on the development of local energy ownership (“prosumerism”) and the increase in energy efficiency of buildings. The Infrastructure Office runs a project for the years 2021-2022 called: Energy model for the capital city in the perspective of 2050, taking into account the conditions of electroprosumerism, which is to describe the possibilities of transforming the city's energy sector towards emission (climate) neutrality.

The Agency's task will be to work with the relevant offices in developing models and strategies. The agency will be responsible for the implementation of activities supporting the city's pursuit of neutrality in the field of energy, gradual independence from centralized energy (fossil-dominated) and the implementation of solutions enabling the reduction of energy consumption.

Optimizing the energy efficiency of buildings would require the modernization of the buildings, the modernization of ventilation and water heating technologies, as well as energy management tools combined with improvements in lighting, appliances and automation. The Municipal Energy Agency will conduct inventories and audits as well as have technical knowledge to implement the most rational solutions. Based on these audits, the unit will maintain a mapped database of energy efficiency in the city. Data mapping will enable visualization of the current energy consumption in the urban environment and take action to improve energy savings. It will allow assessment of the real energy demand of the city and its individual areas.

In order to ensure the implementation of the objectives of the Warsaw GCCAP, in particular the objectives in the field of energy efficiency and RES development, the unit will seek to obtain a license to generate renewable energy sources and manage renewable energy installations in Warsaw.

The implementation of these assumptions will allow the agency to sell green electricity from RES at preferential and stable prices to public and social housing residents who use electricity-based appliances to heat their flats and heat their domestic water.

The Agency's tasks will also include analysing whether the buildings meet the requirements of the Warsaw Green Building Standard, as well as broader activities, certification, related to innovative solutions supporting the city's pursuit of climate neutrality.

## ID E5 Creation of the Municipal Energy Agency

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Enabling action	CE1, CE2, CE4

### Background and justification

The Municipal Energy Agency will lead energy programmes and initiatives, certifications and building audits, and will be responsible for leading purchasing and energy management in the city, under a single leadership and management structure. The Agency will help to attract appropriate Staff, funding and will enable the City of Warsaw to liaise with other energy entities and the government.

### The scale of action / notes on the estimate

The estimation of the costs of developing the strategy for the functioning of the Municipal Energy Agency and the operating costs of the agency's operation was based on the benchmark of market offers, the costs of operating similar units in Poland, many years of experience and extensive knowledge in the implementation of similar projects by the Arup.

### Cost calculation

- Based on: Benchmark of financial statements of the Polish Energy Agency, the Masovian Energy Agency, the National Energy Conservation Agency, the Subcarpathian Energy Agency, the Arup Benchmarks.

- Pre-investment costs are the costs of developing, in cooperation with the City, a strategy for the operation of the Municipal Energy Agency and the implementation of solutions in the energy sector included in the Energy Model for the Capital City of Warsaw with a view to 2050.
- The amount of operating costs assumes the amount of PLB 1.33 million for salaries for employees, management and costs of external services as well as costs related to running an office in the amount of PLN 170 thousand.

### Financing mechanisms

- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.2: Promoting renewable energy CODE 46 Support for entities that provide services that support the low-carbon economy and climate resilience, including awareness-raising activities, 30 million EUR grant;
- Own funds of the City.

### Action owner

- Infrastructure Department

### Bodies supporting the implementation of action

- Air Protection and Climate Policy Department
- Corporate Governance Department

### Stakeholders

- Private enterprises

Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
PLN 350 000 EUR 76 600	-	PLN 1 500 000 EUR 328 500
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
-	-	-
<b>% of total CO<sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions</b>		
-		

## ID E5 Creation of the Municipal Energy Agency

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Enabling action	CE1, CE2, CE4

Steps of implementation	Timeline							
	2023	2024	2025	2026	2027	2028	2029	2030
Development of the new Agency structure in the city: building the structure and scope of responsibilities of the unit								
Developing programmes and benchmarks for programmes to counter energy poverty								
Monitoring and supervision of the implementation of the programmes for counteracting energy poverty								
Conducting regular audits and inventories of the state of implementation of the solutions improving energy efficiency in the city								
Conducting regular audits of the implementation of the Warsaw Green Building Standard in new and redeveloped Municipal buildings								
Building and updating a database and visualization of data on a map about energy efficiency of the city								

## ID E5 Creation of the Municipal Energy Agency

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Enabling action	CE1, CE2, CE4
<b>Product indicator</b>		<b>Result indicator</b>
<ul style="list-style-type: none"> <li>Establishing a unit - Municipal Energy Agency by 2024</li> </ul>		<ul style="list-style-type: none"> <li>Creation and implementation the municipal strategy of achieving climate neutrality in the energy sector in the city,</li> <li>Creation of a mapped database on energy efficiency, enabling the visualization of the current energy consumption in the urban environment and taking actions to improve energy savings.</li> </ul>
<b>Action benefits</b>		
<ul style="list-style-type: none"> <li>Improving the practice of managing city development,</li> <li>Increasing the quality and comfort of life of the inhabitants,</li> <li>Reducing the negative impact on the external environment,</li> <li>Extension a database on energy efficiency in the city, providing the basis for monitoring, analysis and implementation of new solutions,</li> </ul>		<ul style="list-style-type: none"> <li>The creation of a strategy will allow for an analysis of the needs and orientation of the city's future activities,</li> <li>Increase in innovation and competitiveness of the city compared to the rest of the country,</li> <li>Energy saving solution to improve energy efficiency,</li> <li>Decreasing the share of costs allocated to energy in the entire household budget.</li> </ul>
<b>Enabling actions within the Green City and Climate Action Plan of Warsaw</b>		<b>Enabling policies and actions</b>
<ul style="list-style-type: none"> <li>E1 Purchase of green energy for municipal units,</li> <li>E2 Generation of green Energy by the city within and outside Warsaw's borders,</li> <li>E6 Energy strategic partnership,</li> <li>IT2 Smart local energy systems incl. vehicle-to-grid and vehicle-to-building,</li> <li>PS2 Tackling energy poverty.</li> </ul>		<ul style="list-style-type: none"> <li>Poland's energy policy until 2040,</li> <li>Program for improving the energy efficiency of municipal buildings and subsidies for further modernisation of residential buildings.</li> </ul>



## ID E5 Creation of the Municipal Energy Agency

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Enabling action	CE1, CE2, CE4

### Smart potential

- The action effect will be centralization, integration and use of existing data, including development of innovative solutions and their implementation in the city, e.g. creation and supplementation of a database using already conducted research on energy and heat efficiency in the city, such as: the use of laser scanning, aviation ceiling and thermal imaging cameras in analyzes and map studies related to the location of heat losses and enabling more effective data gathering in the future.

### Gender and economic inclusion potential

- In the team of the newly established unit ensuring a balanced participation of representatives of both genders - at the level of researchers, experts and decision-makers.
- Counteracting energy poverty as one of the directions of activities of the Municipal Energy Agency, e.g., through the possibility of reselling green electricity or heat produced by the City on preferential terms to people in a difficult financial situation or energy poverty.

## ID E6 Energy strategic partnership

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2027	Enabling action	CE1, CE2, CE4, CB3

### Description

Establishing a partnership with the Warsaw energy sector in the formulation and implementation of a strategy to achieve climate neutrality by reducing greenhouse gas emissions, implementing renewable energy sources, and improving energy efficiency.

A strategic partnership with the energy sector will have a key role to play in the implementation of the European Commission's Mission - 100 Climate Neutral Cities by 2030, under which Warsaw must develop and then sign a specific agreement tailored to the realities of the city in question and developed through multilateral cooperation to take into account the needs and opinions of all stakeholders on the city's quest for climate neutrality.

Currently, the production of heat and electricity is beyond the competence of the Capital City of Warsaw. Working contacts between city offices and representatives of the energy sector are functioning. The implementation of the Strategic Partnership with the energy sector aims to create a unified cooperation platform to enable a regular, holistic approach to collaboration and transparent communication.

Creating a partnership between the city and the energy sector could result in better coordination

and management, as well as better development of future activities and investments related to urban infrastructure. The city, as the main recipient of heat and electricity, would act as a facilitator and organizer of cyclical meetings and conferences during which strategic activities would be planned and discussed. The partnership would include cooperation with key partners, including: heat producers, including the owner of a combined heat and power plant and heating plant (currently PGNiG Termika S.A.), the owner of the central heating network (transmission and distribution - currently Veolia Energia Warszawa S.A.), electricity distribution network operators (currently Stoen Operator sp. z o.o. and PGE Dystrybucja SA, Warsaw), or the gas network operator (currently PSG sp. z o.o.). Consideration should be given to involving all key companies in terms of achieving the reduction of greenhouse gas emissions, the implementation of renewable energy sources and improvement of energy efficiency, and the desire to use heat from server rooms.

### Background and justification

The city has limited control over the energy system - district heating and electricity networks are regulated by private entities or at the government level.

Building partnership and dialogue with the energy sector may give Warsaw the opportunity to increase its participation and contacts with other energy entities.

### The scale of action / notes on the estimate

The estimated amount of pre-investment costs is the cost of preparing a plan and / or a partnership strategy of the City with the energy sector by an external advisor (e.g. energy market analyzes in terms of renewable energy sources, energy cluster strategy, energy working group) and a platform that will enable continuous cooperation these units. This will allow for the development of a holistic approach and strategic cooperation with the already thriving offices of the City of Warsaw, which are currently implementing numerous contracts with representatives of the energy sector. Estimated operating costs illustrate the annual cost of organizing and coordinating meetings between the City and clients.

### Cost calculation

- Based on: the benchmark of operating costs of municipal energy clusters, market offers, many years of experience and extensive internal knowledge in the implementation of similar projects by the Consultant.

## ID E6 Energy strategic partnership

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2027	Enabling action	CE1, CE2, CE4, CB3

### Financing mechanisms

- Own funds of the City

### Action owner

- Infrastructure Department

### Bodies supporting the implementation of action

- Air Protection and Climate Policy Department

### Stakeholders

- Private enterprises

Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
PLN 150 000	-	PLN 30 000
EUR 33 000		EUR 6 600
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
-	-	-
% of total CO <sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions		
-		

## ID E6 Energy strategic partnership

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2027	Enabling action	CE1, CE2, CE4, CB3

Steps of implementation	Timeline				
	2023	2024	2025	2026	2027
Preparation of a partnership plan / strategy with the energy sector					
Establish a partnership agreement					
Implement the partnership agreement (ongoing work on joint projects and programmes)					

Product indicator	Result indicator
<ul style="list-style-type: none"> <li>Establishing partnership and cooperation of the city with state-owned enterprises</li> <li>Develop a partnership plan / strategy with the energy sector by 2024</li> </ul>	<ul style="list-style-type: none"> <li>Number of cooperation undertaken, contracts / agreements signed in the energy sector to achieve climate neutrality</li> </ul>

## ID E6 Energy strategic partnership

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2027	Enabling action	CE1, CE2, CE4, CB3

### Action benefits

- Reduction in fossil fuels
- Increasing the share of RES
- Reducing energy demand by minimizing losses
- Increased resilience to climate change
- Improved air quality
- Economic integration, allowing for the development of a common goal and direction for the development of the energy sector in the city
- Public involvement
- Improved management and planning of energy infrastructure
- Easy access to information and solutions

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- E1 Purchase of green energy for municipal units,
- E2 Generation of green Energy by the city within and outside Warsaw's borders,
- E5 Creation of the Municipal Energy Agency.

### Enabling policies and actions

- Poland's energy policy until 2040

### Smart potential

- The partnership can work as a platform, or driver, for the the development of new innovative solutions in the field of energy, heating and gas, e.g., development of platforms enabling wholesale trade in electricity and gas, collective purchase of energy by districts government for municipal facilities, as well as the development of regulatory service platforms,
- Data centralization and integration.

### Gender and economic inclusion potential

## ID E7 Creation of a Sustainable Energy Investments Fund

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Enabling action	CR1, CR2, CR3, CT4

### Description

The creation of the Green Fund for Warsaw in May 2021 enabled enterprises to support the city's ecological initiatives aimed at developing green infrastructure, such as maintaining and developing green spaces, mitigating and adapting to climate change, contributing to the preservation and enhancement of biodiversity, or rising the environmental awareness of Warsaw residents.

Based on past activities, the city has the opportunity to identify several plans, or initiatives based on green investments, which should be implemented. Private parties will then be able to choose for themselves which ones to subsidise or fully finance. This mechanism also allows them to implement their own ideas for greening the capital, which will contribute to the development of leisure space for residents, increasing biodiversity in the city or supporting urban gardening.

The Sustainable Energy Investment Fund is a new measure to involve enterprises in the development of the city, building a sense of community and shared responsibility for the city space. The new fund will enable outside entities to participate in the city's energy transformation.

The creation of the Fund for Sustainable Investments will enable the reduction of emissions, development

of renewable energy sources and improving energy efficiency.

The Fund envisaged by the measure would cover the costs of projects meeting certain criteria (potential for reducing greenhouse gas emissions, energy, etc.), including, inter alia, investments related to the development and modernisation of energy infrastructure. Actions could be implemented, for example, in cooperation with private entrepreneurs.

The Sustainable Energy Investment Fund would have the possibility of raising funds from external sources: crowdfunding, from external investors. This part of the Fund would cover up to 1% to 10% of the annual capital. In addition, the City could, with private capital, create a component of the Fund focused on innovation by small and medium-sized enterprises, based on the experience of the Paris Green Fund.

Private enterprises could also obtain additional funds for energy-saving projects through completed ESCO investments. Additional mechanism for financing investments under this fund could be green bonds and revolving loans. The exact proportions between the above-mentioned formulas will be the subject of in-depth analysis at the pre-investment stage, considering the possibilities of external financing (National Recovery Plan, European Funds for Infrastructure, Climate, Environment).

The fund will be promoted among residents. Cooperation with schools is planned to promote green technologies and pro-environmental technologies.

The action should be coordinated with the newly created Municipal Energy Agency to support the identification of the projects with the highest profitability and efficiency ratios.

### Background and justification

A city-managed environmental fund for Warsaw can attract donors to support a targeted program in the city. As in the case of other activities in the field of energy, this action will be easier to implement following the establishment of a dedicated Municipal Energy Agency.

Warsaw is currently implementing a separate, new initiative called the Green Fund for Warsaw, which will be a platform for cooperation with a wide range of entrepreneurs and other entities willing to join in the implementation of the goals indicated in the Environmental Protection Program for the City of Warsaw and the Climate Change Adaptation Strategy for the City of Warsaw until 2030 with an outlook to 2050 Municipal Adaptation Plan. The activity of the Fund has already been initiated by concluding the first agreements with enterprises.

## ID E7 Creation of a Sustainable Energy Investments Fund

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Enabling action	CR1, CR2, CR3, CT4

The Fund for Green Investments will complement the scope of actions of the existing Green Fund for Warsaw to include new forms of financing, including repayable financing.

### The scale of action / notes on the estimate

Pre-investment costs constitute the cost of carrying out the Study to develop the legal framework for the fund's operation. The costs of establishing and operating the Fund will depend on the capital of the Fund at its disposal. This will have a direct impact on the number of people employed, costs of external services. The capital of the newly established fund was assumed to be PLN 10 million per annum over eight full years.

### Cost calculation

- Based on: Consultant's knowledge and experience in the implementation of similar projects, Budget City of Warsaw 2021.
- The amount of pre-investment costs is the cost of developing a legal framework study for the fund's operations. The amount of the fund's annual capital is PLN 10 million and is estimated to be 10 multiples of the green fund. The operating costs represent 3% of this value (on an annual basis).

### Financing mechanisms

- Recovery and Resilience Facility
  - B2.2.2 RES investments by energy communities (including municipalities), 97 million EUR in grants
  - B.3.4.1 Investments for comprehensive green transformation of cities, 2800 million EUR loans
- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.2 Promoting renewable energy
    - CODE 46. Support for entities that provide services that support the low-carbon economy and climate resilience, including awareness-raising activities, 30 million EUR in grants
- Own funds of the City

### Action owner

- Infrastructure Department

### Bodies supporting the implementation of action:

- Air Protection and Climate Policy Department

### Stakeholders

- private entrepreneurs
- Local society

Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
PLN 350 000	PLN 80 000 000	PLN 300 000
EUR 76 600	EUR 17 500 000	EUR 65 700
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
-	-	-
% of total CO <sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions		
-		

## ID E7 Creation of a Sustainable Energy Investments Fund

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Enabling action	CR1, CR2, CR3, CT4

Steps of implementation	Timeline							
	2023	2024	2025	2026	2027	2028	2029	2030
Creation of fund operating mechanisms								
Fund promotion								
Investor involvement and use of the fund's resources								

Product indicator	Result indicator
<ul style="list-style-type: none"> <li>Creation and launch of a Green Investment Fund by 2024</li> </ul>	<ul style="list-style-type: none"> <li>The level of annual capital obtained from energy cost savings [PLN],</li> <li>Annual level of funds obtained from external sources for the needs of the fund [PLN],</li> <li>Annual number of activities undertaken as part of collaborations with schools to promote green technologies and pro-environmental technologies,</li> <li>% of reduction in greenhouse gases.</li> </ul>



## ID E7 Creation of a Sustainable Energy Investments Fund

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Enabling action	CR1, CR2, CR3, CT4

### Action benefits

- Reduction in energy demand,
- Renewable energy growth / reduction of fossil fuels,
- Protection and improvement of the environmental conditions for the functioning and increase of green areas,
- Increased resilience to climate change,
- Private vehicle mode split decreased,
- Economic integration, as a result of developing a joint fund supporting sustainable development in the city,
- Gender equality: solutions / projects should take into account the gender perspective and the needs of disadvantaged groups already at the stage of research and validation of the idea (*gender mainstreaming*),
- Public involvement.

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- E2 Generation of green Energy by the city within and outside Warsaw's borders,
- B1 Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction,
- B2 Program to improve the energy efficiency of municipal buildings with a pilot,
- R1 Increasing biologically active surfaces and removing impermeable surfaces,
- B3 Continued replacement of high-emission heat sources,
- PS1 Education campaigns,
- E5 Creation of the Municipal Energy Agency.

### Enabling policies and actions

- The Green Fund for Warsaw as a new fundraising mechanism established by the Green Management Board of the Capital City of Warsaw,
- Warsaw Climate Panel (recommendation: The city should lead "positive energy motivation" at the district level and raise additional funds for investments (investments related to climate protection) for the district in exchange for reducing energy consumption or increasing energy efficiency by a certain percentage).

## ID E7 Creation of a Sustainable Energy Investments Fund

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Enabling action	CR1, CR2, CR3, CT4

Smart potential	Gender and economic inclusion potential
<ul style="list-style-type: none"> <li>• Creation of a crowdfunding platform targeting green investors and/or committed citizens,</li> <li>• Use of the platform to register companies and projects.</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of solutions ensuring balanced participation of representatives of both genders in the structures of the Fund,</li> <li>• It is necessary to ensure a balanced participation of representatives of both genders in the structures of the Fund - especially in the area of decision-making, management, investment committee, and among investors.</li> </ul>

## ID E8 Outdoor city lighting – LED retrofit

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2027	Capital program	CE3
<p><b>Description</b></p> <p>Modernization of outdoor lighting in the city, on streets and green areas, in parks - depending on individual needs with the use of "LED &amp; smart" lighting and replacement of street and park lamps with multifunctional energy-saving LED lamps. The modernization process will ensure appropriate fauna and flora-friendly parameters and highly controllable LED lamps. Additionally, if necessary, the lamps will be equipped with Wi-Fi transmitters for local hotspots, environment monitoring equipment, making it possible to publish messages via fixed or variable banners. Dodatkowe wyposażenie latarni ulicznych może obejmować również kamery monitoringu bezpieczeństwa.</p> <p>Lighting poles with communication functions, in addition to the lighting function, can be a key element of gathering and presenting information from monitoring and measurements using sensors in the city, both for air quality and traffic management.</p> <p>The lighting will provide reduced energy consumption and improvements to safety and security for city residents and visitors. The program will incorporate best practice measures to reduce light pollution to improve habitats conditions in the city for flora and fauna. The lighting parameters should be selected according to the location, way of development and functions of land.</p>	<p>A good practice will be to use the experience of modernization projects carried out in the city. Municipal Roads Authority conducts investments in the field of lighting replacement, during the process they developed guidelines for reducing light pollution.</p> <p><b>Background and justification</b></p> <p>This action builds on the partial implementation of lighting modernization completed to date: In 2021, the city procured the delivery of new LED lighting for over 38,000 luminaires across the city. However, a further 60,000 luminaires are to be replaced. The city should continue its activities in this matter in the coming years. Replacing and installing streetlamps and green areas, parks with energy-saving, multi-functional LED lamps will reduce greenhouse gas emissions for lighting by 40% and will have a positive impact on energy savings and reduce light pollution.</p> <p><b>The scale of action / notes on the estimate</b></p> <p>Estimation of the proportional cost of replacing 60,000 LED luminaires based on the actual tender of the City of Warsaw for the replacement of 38,500 LED luminaires at a price of PLN 32,080,000<sup>54</sup>. The estimated costs may significantly increase in the case of diagnosing conservation works that are difficult to ascertain at the moment, which would require ground works, interference with power networks and possible aesthetic aspects.</p>	<p><b>Cost calculation</b></p> <ul style="list-style-type: none"> <li>• Based on: Public procurement for the supply of new lighting fittings in LED technology for the capital city of Warsaw in 2021, Zdm.waw.pl, the online platform of the manufacturer of LED luminaires (selected through the above-mentioned tender)</li> <li>• Capital expenditure represents the cost of purchasing and replacing 60,000 new LED luminaires. The presented operating costs constitute the cost of purchasing electricity needed for the proper functioning of the new LED luminaires<sup>55</sup>.</li> <li>• On the basis of the above-mentioned public order the cost of 1 LED luminaire was set at 833.25 PLN. Operating costs refer to tender data. Costs of supplying these luminaires with energy amounted 9,54 mln PLN, with energy cost 14,9 mln PLN. The re-estimated savings were compared to the data presented for the above-mentioned tender, where the exchange of 38.5 thousand LED luminaires gave the city over 33 GWh of energy savings, which allowed to save over 17.5 million PLN annually. Proportional to the number of 60 thousand of new LED luminaires, energy savings would exceed 51 GWh and would bring savings of over 27 million PLN.</li> </ul>

## ID E8 Outdoor city lighting – LED retrofit

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2027	Capital program	CE3

### Financing mechanisms

- Recovery and Resilience Facility
  - B3.4.1 Investments for comprehensive green transformation of cities, 2800 million EUR in loans,
- Own funds of Energy Service Company enterprises
- Loans, credits, green bonds
- Own funds of the City
- NFOŚiGW (National Fund for Environmental Protection and Water Manager)
- WFOŚiGW (Voivodeship Fund for Environmental Protection and Water Manager)

Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
-	PLN 50 000 000	PLN 14 900 000
	EUR 11 000 000	EUR 3 300 000
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
Reduction of energy consumption by 51,43 GWh per year, which would reduce lighting bills by: <ul style="list-style-type: none"> <li>• PLN 27 000 000 per year</li> <li>• EUR 5 900 000 per year</li> </ul>	ok. 35 900 tCO <sub>2</sub> /year	0.30%
% of total CO <sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions		
2.99%		

### Action owner

- **Municipal Roads Authority**

### Stakeholders

- Architecture & Spatial Planning Department
- Greenery management of the capital city of Warsaw
- City districts

## ID E8 Outdoor city lighting – LED retrofit

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2027	Capital program	CE3

Steps of implementation	Timeline				
	2023	2024	2025	2026	2027
Selecting the areas covered by modernization and establish procurement process					
Implementation of lighting replacement					

Product indicator	Result indicator
<ul style="list-style-type: none"> <li>• Number of energy-saving lamps installed along streets and green and public areas.</li> <li>• Number of lamps equipped with Wi-Fi transmitters for local hotspots, equipment for monitoring the environment.</li> <li>• 60,000 new LED luminaires installed by 2027.</li> </ul>	<ul style="list-style-type: none"> <li>• % of energy and financial savings in the city lighting sector.</li> <li>• Light pollution reduction level - number of luminaires with warm color temperature installed, including the number of luminaires with a warm colour temperature installed in areas of natural value, previously selected under Measure R4 Protection and restoration of valuable natural areas.</li> <li>• The level of safety of residents in public spaces and green areas.</li> </ul>

## ID E8 Outdoor city lighting – LED retrofit

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2027	Capital program	CE3
<b>Action benefits</b>		
<ul style="list-style-type: none"> <li>• Reduction in energy demand</li> <li>• Climate change mitigation and buffering</li> <li>• Limitation of light pollution</li> <li>• Lighting with parameters friendly to fauna and flora</li> <li>• An energy-saving solution that reduces energy consumption</li> <li>• Financial savings</li> <li>• Reduction in greenhouse gas emissions</li> <li>• Providing residents with Wi-Fi on the street</li> <li>• Flexibility to reduce lighting times while meeting the lighting needs of pedestrians, cyclists, and drivers</li> <li>• Greater lighting functionality, incl. reduced clutter on the street (by putting more functions in one set of lanterns)</li> </ul>		
<b>Enabling actions within the Green City and Climate Action Plan of Warsaw</b>		<b>Enabling policies and actions</b>
<ul style="list-style-type: none"> <li>• R2 Protection and restoration of valuable green areas</li> <li>• R4 Greening streets</li> </ul>		<ul style="list-style-type: none"> <li>• Poland's energy policy until 2040</li> <li>• Lighting modernization program in Warsaw</li> <li>• Study of the conditions and directions of spatial development for the Capital City of Warsaw</li> </ul>

## ID E8 Outdoor city lighting – LED retrofit

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2027	Capital program	CE3

Smart potential	Gender and economic inclusion potential
<ul style="list-style-type: none"> <li>• Create big data in real-time for better city decision making: implement individual lighting control, correct program selection, light intensity, correct lighting and extinguishing times, manage street lighting maintenance, as well as provide comprehensive lighting service,</li> <li>• Implementation of energy-saving technologies and technologies reducing light pollution,</li> <li>• Implementation of systems: Wi-Fi transmitters for local hotspots, equipment for environmental monitoring, and the possibility of publishing messages via fixed or variable banners,</li> <li>• Opportunity to use street lighting poles as data-communication hubs and data capture for multiple purposes. Light poles with wireless communication functions (often functioning in clusters) can be key pieces to implement sensors in the city, for both air quality, traffic management (beyond lighting). Banners can present current air quality data, using sensors from the Warsaw Air Quality Monitoring programme, or data on traffic in the city, using real-time data collected by the Public Transport Authority.</li> </ul>	<ul style="list-style-type: none"> <li>• When implementing new lighting, the aspect of light pollution analysis should be taken into account in the context of shaping sustainable outdoor lighting, but also the aspect of the safety and psychological comfort of the inhabitants, especially in terms of safety in public spaces, at pedestrian crossings, comfort and safety of elderly people, children and people with disabilities. New lighting - its layout, character, and power - should strengthen this safety, while respecting the postulate of limiting the phenomenon of light pollution.</li> <li>• When designing a Wi-Fi access service scheme, the requirements of UX design are based on addressing the needs of various groups of recipients - including women, people with disabilities (including visually impaired), non-Polish-speaking people (or with the basic ability to communicate in Polish) should be applied. The available language options should reflect the specificity of the nationality of the city's community.</li> </ul>

# Buildings





## ID B1 Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2026	Policy action	CB1, CB2, CB3
<p><b>Description</b></p> <p>Developing and implementing the best construction standards to influence the technologies and solutions used in new buildings. Improving the practice of renovating existing buildings to improve energy efficiency and provide low-carbon supplies.</p> <p>The city is in the process of proceeding Warsaw Green Building Standard (it will be a set of guidelines and recommendations for new and modernized urban facilities). The prepared recommendations will be based on norms consistent with the provisions of the Standard, conservation recommendations and the existing regulations and rules for the implementation of investments in the retrofitting, modernisation and renovation of buildings in the city, in addition it will be extended by good practices concerning environmental protection in the performance of these tasks, including the collision of birds with glass surfaces and the preservation of breeding sites for birds (e.g. passerines). By using the potential of projects in BIM technology to create a database of urban buildings, it will be possible to monitor and compare emissions assumed at the design stage and actual emissions during use. Moreover, it is planned to prepare a set of trainings and solutions aimed at increasing the skills of developers in order to ensure higher standards.</p>	<p>This creates also the potential for implementation of a cost-efficient pathway of making buildings EV-ready, which could include allocating a minimum amount of parking spots for example to those with charging points or enabling bidirectional charging in homes (vehicle to building, vehicle to home, solar-EV).</p> <p>This standard will be mandatory for all new buildings. In addition, it will also apply to existing buildings in the event of a desire to obtain funding under the city's thermal modernisation programmes, where it will be physically possible and economically reasonable to bring an existing building up to the new standards.</p> <p><b>Background and justification</b></p> <p>The energy efficiency and sustainable development of new buildings is the third largest mitigation strategy in the Pathways model (model of emission pathways and achieving climate neutrality) for Warsaw, achieving CO2 emission reduction by 2050.</p> <p>The zero-carbon track means that almost every existing building in the city needs significant energy efficiency improvements and many will need to switch from their current energy supply (e.g., from gas and solid fuel to heat pumps or a future low-carbon district heating network).</p>	<p>It is also a requirement of the EU Nearly Zero Energy Buildings Directive (NZEB). The implementation of best practice standards will help to gradually modernization buildings to minimize energy consumption in this sector.</p> <p>Meanwhile, the city is working on new standard for new buildings to avoid the additional challenges of modernization. Buildings retrofits will generate significant savings for residents and the city. During the development of these documents, it is also important to ensure that their provisions are consistent with the European taxonomy regarding to the establishment of a framework to facilitate sustainable investment.</p> <p><b>The scale of action / notes on the estimate</b></p> <p>The costs relate to the development of a set of standards based on the Warsaw Green Building Standard and a set of training and instructional materials regarding the requirements that should be included in the design documentation prepared for the renovation of buildings and new facilities.</p> <p><b>Cost calculation</b></p> <ul style="list-style-type: none"> <li>Based on: the benchmark of market offers, many years of experience and extensive knowledge in the implementation of similar projects by Arup.</li> </ul>

## ID B1 Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction

Timescale	Type of action	Short-term objectives of the GCCAP		
2023–2026	Policy action	CB1, CB2, CB3		
<p><b>Cost calculation cont.</b></p> <ul style="list-style-type: none"> <li>The amount of pre-investment costs is the cost of developing a set of standards based on the Warsaw Green Building Standard, training and instructional materials regarding the requirements that should be included in the design documentation prepared for the renovation of buildings and new facilities.</li> </ul> <p><b>Financing mechanisms</b></p> <ul style="list-style-type: none"> <li>Own funds of the City</li> </ul> <p><b>Action owner</b></p> <ul style="list-style-type: none"> <li><b>Architecture &amp; Spatial Planning Department</b></li> </ul> <p><b>Bodies supporting the implementation of action</b></p> <ul style="list-style-type: none"> <li>Architecture and Spatial Planning Department</li> <li>Heritage Protection Department</li> <li>Infrastructure Department</li> <li>Local Policy Department</li> <li>City districts</li> </ul> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>City companies</li> <li>Private entrepreneurs</li> <li>Local society</li> </ul>	<b>Pre-investment</b>	<b>CAPEX</b>	<b>OPEX</b>	
	<b>(PLN, EUR)</b>	<b>(PLN, EUR)</b>	<b>(PLN, EUR)</b>	
	PLN 350 000	-	-	
	EUR 76 600			
	<b>Estimated savings</b>	<b>Estimated CO<sub>2</sub> emission reduction</b>	<b>% reduction in GHG emissions compared to the 2018 inventory year</b>	
	-	-	-	
<b>% of total CO<sub>2</sub> emission reduction from proposed Green and Climate City Action Plan of Warsaw actions</b>				
-				

## ID B1 Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2026	Policy action	CB1, CB2, CB3

Steps of implementation	Timeline			
	2023	2024	2025	2026
Development and implementation of standards consistent with the provisions of the Warsaw Green Building Standard				
Conducting trainings for all groups related to the implementation and enforcement of the Warsaw Green Building Standard				

Product indicator	Result indicator
<ul style="list-style-type: none"> <li>Using the Warsaw Green Building Standard for new and modernized buildings in the city</li> <li>Number of conducted courses / trainings on the implementation of standards and best practices in sustainable construction</li> <li>Number of buildings prepared for synergy with the infrastructure for electric vehicles (for the implementation of vehicle to building, vehicle to home systems, solar systems)</li> <li>50% of new buildings constructed in accordance with WGBS by 2030</li> </ul>	<ul style="list-style-type: none"> <li>% of renovation of municipal buildings completed in accordance with the requirements of the Warsaw Green Building Standard</li> <li>% of new buildings constructed in accordance with the Warsaw Green Building Standard</li> <li>% of renovation of buildings conducted in accordance with the Warsaw Green Building Standard</li> </ul>

## ID B1 Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2026	Policy action	CB1, CB2, CB3

### Action benefits

- Reduction in energy demand
- Renewable energy growth / reduction of fossil fuels
- Increasing and / or protection of green areas
- Increased resilience to climate change
- Increased rainwater retention
- Economic integration
- Public involvement
- Conducting research and development works consequently leads to the development of a given sector and an increase in the competitiveness and innovation of the implemented solutions.

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- E5 Creation of the Municipal Energy Agency
- E6 Energy strategic partnership
- B2 Program to improve the energy efficiency of municipal buildings with a pilot

### Enabling policies and actions

- STOP SMOG - Clean Air Program
- Warsaw Green Building Standard
- Warsaw Climate Panel (recommendation - Creation of a Warsaw green building standard, which is a set of rules, requirements and guidelines leading to the achievement of urban climate goals in the construction sector)
- Design standards applicable in the city (e.g., The well-designed school)

## **ID B1 Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction**

<b>Timescale</b>	<b>Type of action</b>	<b>Short-term objectives of the GCCAP</b>
2023–2026	Policy action	CB1, CB2, CB3

<b>Smart potential</b>	<b>Gender and economic inclusion potential</b>
<ul style="list-style-type: none"> <li>• New standards should include a standard for intelligent energy management in buildings or provide appropriate incentives for such solutions</li> </ul>	<ul style="list-style-type: none"> <li>• Applying new standards in the construction of new buildings related to the optimization of energy efficiency and bringing people closer to zero emission</li> <li>• Implementing the principles of universal design</li> </ul>

## ID B2 Program to improve the energy efficiency of municipal buildings with a pilot

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CB1, CB2, CB3
<p><b>Description</b></p> <p>A pilot programme for the modernisation of public buildings including thermal modernisation of buildings, installation of heat pumps, renewal of ventilation systems, implementation of intelligent lighting systems and continuation of the operation and maintenance of the Anti-Smog Fund (educational buildings will be analysed first).</p> <p>Energy modernization of buildings is aimed at reducing the consumption of heat, electricity and water. Taking into account the condition of city buildings - i.e., buildings belonging to the capital city of Warsaw; municipal and residential companies, especially municipal residential and service buildings, including public buildings, priority should be given to reducing heat losses in a building, i.e., activities covering;</p> <ul style="list-style-type: none"> <li>• insulation of building partitions,</li> <li>• replacement of woodwork,</li> <li>• mechanical ventilation systems with heat recovery.</li> </ul> <p>Thermomodernisation should also involve increasing the share of renewable energy through the installation of heat pumps and photovoltaic panels. An important thermal modernization activity is connecting municipal housing buildings to the heating network thanks to which individual</p>	<p>ineffective heat sources based on electricity or solid fuels will be eliminated. Ultimately, all municipal buildings should be equipped with an automatic building management system (BMS). Solutions that save drinking water and reuse rainwater are also important. The construction of green facades and green roofs will contribute to the improvement of microclimatic conditions in buildings. In addition, it is important to use automatic light switches, and to replace the light points with LEDs. Detailed guidelines for modernization will be included in; Warsaw Green Building Standard, Architectural Standards contained in the Warsaw Housing Standard and standards for primary schools and school and kindergarten complexes of the Capital City of Warsaw.</p> <p>The city will aim to conducting a stricter controls overheat sources in residential buildings (in and around Warsaw).</p> <p><b>Background and justification</b></p> <p>Activities focused on the energy modernization of municipal buildings will contribute to the improvement of the energy efficiency of buildings and the reduction of electricity and heat consumption. Although, these actions require the involvement of very large funds.</p>	<p>The greenhouse gas emission reduction scenarios developed for the purposes of the Green City and Climate Action Plan of Warsaw clearly indicate that it is impossible to achieve climate neutrality without a significant improvement in the energy efficiency of buildings. In addition to reducing greenhouse gas emissions, thermomodernisation of buildings will also bring benefits in the form of reduced maintenance costs. The financing formula in the PPP model would only be suitable for the thermal modernisation of municipal buildings.</p> <p><b>The scale of action / notes on the estimate</b></p> <p>According to the data presented by the Air Protection and Climate Policy Department of the Warsaw City Authority and the information contained in the study carried out in Warsaw in April 2019, entitled 'The City of Warsaw. List of buildings managed by the City of Warsaw in terms of energy efficiency', the City is in possession of 5,204 municipal buildings. Of these, the City has a minority share in 1,358 buildings and they will not be subject to thermal upgrading under this measure. It has identified 84 single-family buildings (including 17 buildings with historical characteristics) and 1,113 multi-family buildings (including 590 buildings with historical characteristics) that are in need of retrofit work related to increasing the energy efficiency of the facility.</p>

## ID B2 Program to improve the energy efficiency of municipal buildings with a pilot

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CB1, CB2, CB3

### The scale of action / notes on the estimate cont.

In addition, 1,205 public buildings (including 237 listed buildings) need to be included in thermomodernisation processes.

### Cost calculation

- Based on: Air Protection and Climate Policy Department, List of buildings managed by the Capital City of Warsaw in terms of energy efficiency April 2019, Central Statistical Office, Budget of the Capital City of Warsaw 2021, public procurement for the construction works for the comprehensive thermomodernisation of 4 public utility buildings located in Gdynia, thermomodernisation of the municipal building in Czaniec Zagłębcze 9 Street together with installation of a photovoltaic installation, thermomodernisation of the K. K. Baczyński School Complex No. 32 building in Warsaw, thermomodernisation of Primary School No. 322 and Kindergarten No. 401 at 9 Dembowskiego Street in Warsaw.

- The costs of thermomodernisation of standard buildings were estimated on the basis of the above-mentioned public procurement. The average cost of the thermomodernisation process for a standard building was estimated at 1.55 million PLN (340.5 thousand EUR). The average cost of thermomodernisation of historical buildings was estimated on the basis of investments in the revitalisation of historical tenements in Warsaw included in the budget of the City of Warsaw 2021 at 3.2 million PLN (700,000 EUR). Both values were indexed with the average value of the index of changes in the prices of construction and assembly works (35 components)<sup>56</sup> to the value in Q1 2022. Thermomodernisation would involve upgrading the facades of the buildings, replacing conventional heat sources, upgrading HVAC (heating, ventilation and air conditioning) technology, water heating and automating energy management tools.

- Taking the information from the Air Protection and Climate Policy Department and the above-mentioned report as the baseline data, there are still 1,205 public buildings (including 237 buildings with historical features) and 1,197 residential buildings, both single-family and multi-family (including 607 with historical characteristics).
- Estimated savings based on the Polish National Audit Office report 'Energy efficient investments in public buildings'. Where for 1,464 buildings a CO<sub>2</sub> reduction of 238,997 Mg CO<sub>2</sub>/year was estimated.

## ID B2 Program to improve the energy efficiency of municipal buildings with a pilot

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CB1, CB2, CB3

### Financing mechanisms

- Recovery and Resilience Facility

B1.1.2. Replacement of heat sources and improvement of energy efficiency in residential buildings (including multi-family housing), 3201 million EUR of grants

B1.1.3. Replacement of heat sources and improvement of energy efficiency in schools, 280 million EUR grants

B1.1.4. Replacement of sources and improvement of energy efficiency in community facilities, 67 million EUR grants

- European Funds for Infrastructure, Climate, Environment Program 2021-2027

Objective 2.1. Promoting energy efficiency and reduction of greenhouse gas emissions

CODE 44. Renovation increasing energy efficiency of public infrastructure, demonstration projects and support activities, 620 million EUR grants

- National Fund for Environmental Protection and Water Management, "Stop Smog" Program, 518 million PLN, grants
- Own funds of the City
- PolSeFF Program (Polish Sustainable Energy Financing Facility)
- Public-Private Partnership

### Action owner

- Air Protection and Climate Policy Department**

### Bodies supporting the implementation of action

- Infrastructure Department
- Housing Policy Department
- Education Department
- Capital City Development Authority
- Economic Development Department
- City districts

### Stakeholders

- City companies
- Private entrepreneurs
- Local society



## ID B2 Program to improve the energy efficiency of municipal buildings with a pilot

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CB1, CB2, CB3
Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
-	Public buildings and others: Standard: <ul style="list-style-type: none"> <li>• PLN 1 505 500 000</li> <li>• EUR 329 700 000</li> </ul> Historical: <ul style="list-style-type: none"> <li>• PLN 760 770 000</li> <li>• EUR 166 600 000</li> </ul> Municipal housing: Standard: <ul style="list-style-type: none"> <li>• PLN 917 600 000</li> <li>• EUR 201 000 000</li> </ul> Historical: <ul style="list-style-type: none"> <li>• PLN 1 948 500 000</li> <li>• EUR 426 700 000</li> </ul>	-
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
Thermomodernization of 2,402 buildings: <ul style="list-style-type: none"> <li>• PLN 221 100 000</li> <li>• EUR 48 400 000</li> </ul> thermal energy costs per year	392 125 tCO <sub>2</sub> /year	3.26%
% of total CO <sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions		
32.65%		

## ID B2 Program to improve the energy efficiency of municipal buildings with a pilot

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CB1, CB2, CB3

Steps of implementation	Timeline							
	2023	2024	2025	2026	2027	2028	2029	2030
Conducting a location analysis research on the needs and requirements of residents								
Obtaining financing								
Conducting a tender to select contractors								
Start of construction work for thermal modernisation of buildings								
Continuation of the assumptions of the solid fossil fuel heating replacement program for low-emission technologies of generating heating and hot water								

Product indicator	Result indicator
<ul style="list-style-type: none"> <li>Number of educational buildings undergoing thermalmodernisation</li> <li>Carry out thermomodernisation of a minimum of 100 buildings per year by 2030</li> </ul>	<ul style="list-style-type: none"> <li>Number of municipal buildings equipped with an automatic building control system</li> <li>number of thermo-modernised buildings</li> </ul>

## ID B2 Program to improve the energy efficiency of municipal buildings with a pilot

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CB1, CB2, CB3

### Action benefits

- Reduction in energy demand
- increased use of RES and reduction of fossil fuels
- Protection and development of green spaces
- Increased resilience to climate change
- Improving the operation of the sewerage and rainwater network and relieving the network through the use of BZI (blue-green infrastructure) elements
- Reduced greenhouse gas emissions from buildings sector
- Energy saving solution to improve energy efficiency
- improved air quality, both outdoors and indoors, thanks to ventilation upgrades
- Economic integration, by providing residents with lower energy consumption
- Improving the conditions and comfort of living and public utility buildings
- Lower heating costs of residential and public buildings
- Lower costs of water heating in residential and public buildings
- Reducing the negative impact on the external environment

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- E5 Creation of the Municipal Energy Agency
- E6 Energy strategic partnership
- PS2 Tackling energy poverty
- B3 Continued replacement of high-emission heat sources
- B1 Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction

### Enabling policies and actions

- STOP SMOG - Clean Air Program
- Warsaw Green Building Standard
- Architectural and functional standards for primary schools and kindergarten complexes of the Capital City of Warsaw
- Warsaw Climate Panel (recommendation: Implementation of an energy management system in all municipal public buildings based on the PN-EN ISO 50001 Energy Management Standards).

## ID B2 Program to improve the energy efficiency of municipal buildings with a pilot

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CB1, CB2, CB3

Smart potential	Gender and economic inclusion potential
<ul style="list-style-type: none"> <li>Implementation of modern technologies improving energy efficiency, rainwater management, and others including:               <ul style="list-style-type: none"> <li>The retrofitting of municipal buildings should include best available technologies in terms of smart energy management in buildings, also for demonstrative purposes. It should consider the systematic implementation in equipped with an automatic building management system (BMS) and solutions that save drinking water and reuse rainwater, implementation of automatic light switches, and replace the light points with LEDs.</li> <li>Installation of information and education boards on the achieved emission reductions in buildings of educational institutions.</li> </ul> </li> <li>Using retrofit educational buildings as a platform for educational/awareness purposes.</li> <li>Implementation of systems for monitoring the effectiveness of retrofit.</li> </ul>	<ul style="list-style-type: none"> <li>Connecting municipal buildings to the heating network and the thermal modernization of these residential buildings will be of great importance in the fight against energy poverty of tenants. Such actions will lead to the improvement of the housing conditions of municipal tenants. Change of heat sources and thermal modernization has the potential to lead them out of energy poverty. Changes in the prices of energy sources should be taken into account in order to be able to respond to their effects and support vulnerable consumers.</li> <li>When modernizing buildings, the needs of people with reduced mobility should be taken into account and the principles of universal design should be applied.</li> <li>The implementation of investments considering different user groups, providing them with a sense of identity and belonging.</li> <li>As often the municipal housing buildings are inhabited by lower income citizens, temporary flats should be envisaged for the renovation periods.</li> </ul>

## ID B3 Continued replacement of high-emission heat sources

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CB1, CB2, CB3

### Description

In 2021, with the support of the city, a total of 1,396 furnaces were replaced in Warsaw, of which 1,074 in private housing stock. The total amount of subsidies for this purpose for residents of the capital exceeded 28 million PLN. A total of 4,310 fossil fuel boilers were replaced between 2017 and 2021 using city funds: 2,794 in the private stock and 1,516 in the municipal stock. However, more than 5,800 classless boilers or furnaces remain to be replaced. According to the current city policy, when replacing solid fossil fuel heating sources, priority should be given to heat pumps as a new heat source along with photovoltaic installations.

As a result of the successful completion of the current program for the replacement of solid fuel boilers, this program should be continued. This program would be aimed at regularly replacing the majority of old and inefficient gas boilers, e.g., by replacing them with heat pumps or by installing photovoltaic panels.

### Background and justification

The program of exchanging high-emission heating sources is justified both in terms of improving air quality (elimination of pollutants with suspended dust and benzo(a)pyrene) and in terms of climate - reduction of greenhouse gas emissions.

Moreover, the blackcoat exchange program is justified by the so-called anti-smog resolution<sup>57</sup> stricter prohibitions on the use of classless solid fuel boilers. Additionally, program would mitigate the expected increase in energy poverty level due to Ukraine invasion and resulting increase in fuel prices.

Replacing old and ineffective gas stoves with heat pumps with photovoltaics is justified by the need to reduce greenhouse gas emissions, striving for climate neutrality in Warsaw and the related transition to zero-emission heat sources.

### The scale of action / notes on the estimate

Capital expenditure includes the cost of continuing to run and operate the fossil fuel replacement program and the cost of running the program to replace inefficient gas boilers.

### Cost calculation

- Based on: Air Protection and Climate Policy Department, Data from the web portal of Warsaw City Office, Polish Central Statistical Office.
- The average cost of one subsidy under the „Program wymiany kopciuchów” and „Program wymiany nieefektywnych kotłów gazowych” – replacement of solid fossil fuel heating sources and inefficient gas boilers is 5,370 EUR (26,000 PLN).

It is estimated that there are still 5,800 unclassified boilers or furnaces to be replaced in residents (in both private and communal housing estates), and this figure may increase further after additional analysis of around 2,000 buildings where extra inventory activities are needed. In parallel, it is assumed that around 500 subsidies will be provided per year between 2026 and 2030 (a five-year period) for the replacement of inefficient gas boilers.

- The operating costs are the administrative costs related to the remuneration of the officials (10 new full-time positions), who will deal with the grant applications. The average monthly salary in municipal administration in 2021 was approximately 6,000 PLN gross.

### Financing mechanisms

- Recovery and Resilience Facility
  - B1.1.2. Replacement of heat sources and improvement of energy efficiency in residential buildings (including multi-family housing), 3201 million EUR of grants
  - B1.1.3. Replacement of heat sources and improvement of energy efficiency in schools, 280 million EUR grants
  - B1.1.4. Replacement of sources and improvement of energy efficiency in community facilities, 67 million EUR grants

## ID B3 Continued replacement of high-emission heat sources

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CB1, CB2, CB3

### Financing mechanisms cont.

- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.1. Promoting energy efficiency and reduction of greenhouse gas emissions
  - CODE 44. Renovation increasing energy efficiency of public infrastructure, demonstration projects and support activities, 620 million EUR grants
  - National Fund for Environmental Protection and Water Management, "Stop Smog" Program, 518 million PLN, grants
  - Own funds of the City
  - PolSeFF Program (Polish Sustainable Energy Financing Facility)

### Action owner

- **Air Protection and Climate Policy Department**

### Bodies supporting the implementation of the action

- Local society
- Private entrepreneurs
- NGOs

Pre-investmen (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
-	Subsidies for the replacement of solid fossil fuel heating sources: <ul style="list-style-type: none"> <li>• PLN 150 800 000</li> <li>• EUR 33 021 000</li> </ul> Subsidies for the replacement of inefficient gas boilers: <ul style="list-style-type: none"> <li>• PLN 65 000 000</li> <li>• EUR 14 200 000</li> </ul>	PLN 720 000 EUR 157 700
<b>Estimated savings</b>	<b>Estimated CO<sub>2</sub> emission reduction</b>	<b>% reduction in GHG emissions compared to the 2018 inventory year</b>
-	Replacement of 5,800 classless furnaces (55% for coal and 45% for wood) with: 50% gas furnaces (temporarily), 40% to heat pumps with PV installations and 10% to heat pumps without PV installations.  83,986 tCO <sub>2</sub> /year	0.7%
<b>% of total CO<sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions</b>		
6.99%		

## ID B3 Continued replacement of high-emission heat sources

<b>Timescale</b>	<b>Type of action</b>	<b>Short-term objectives of the GCCAP</b>
2023–2030	Capital program	CB1, CB2, CB3

<b>Steps of implementation</b>	<b>Timeline</b>							
	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>	<b>2030</b>
Continuation of the solid fossil fuel heating sources replacement program								
Replacement program for ineffective gas boilers								

<b>Product indicator</b>	<b>Result indicator</b>
<ul style="list-style-type: none"> <li>• Number of solid fossil fuel heating sources replaced</li> <li>• Implementation of the replacement of a minimum of 1 000 fossil fuels per year between 2023 and 2027.</li> <li>• Implementation of the replacement of a minimum of 500 inefficient gas boilers per year between 2026 and 2030.</li> </ul>	<ul style="list-style-type: none"> <li>• % of reduction in greenhouse gases</li> <li>• % of decrease in emissions of pollutants into the air from the low emission sector</li> </ul>

## ID B3 Continued replacement of high-emission heat sources

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CB1, CB2, CB3

### Action benefits

- Improved air quality
- Reduction in energy demand
- Reduced greenhouse gas emissions
- Renewable energy growth / reduction of fossil fuels
- Increased resilience to climate change
- Energy saving solution to improve energy efficiency
- Economic integration, by providing residents with lower energy consumption
- ‘Green jobs’ - renewable energy industry
- Improving the conditions and comfort of living
- Pursuing to reduce costs of domestic heating and water in residential buildings
- Implementation of protective mechanisms for residents suffering from energy poverty
- Lower heating costs for residential buildings
- Lower costs of water heating in residential buildings
- Increase in the value of residential and public buildings
- Reducing the negative impact on the external environment

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- E5 Creation of the Municipal Energy Agency
- E6 Energy strategic partnership
- PS2 Tackling energy poverty
- B1 Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction
- B2 Program to improve the energy efficiency of municipal buildings with a pilot

### Enabling policies and actions

- Resolution No. XIX / 487/2019 of the Council of the Capital City of Warsaw of September 26, 2019, on the rules for granting a targeted subsidy for financing or co-financing investments in the capital city of Warsaw, serving environmental protection and water management
- STOP SMOG - Clean Air Program
- Warsaw Green Building Standard
- Warsaw Climate Panel (recommendation: launching a support system for building owners (including historic buildings) in the process of Deep Thermal Upgrading)
- Air protection programme for zones in the Mazowieckie Voivodeship in which permitted and target levels of substances in the air were exceeded.
- Grants for investments in the use of local renewable energy sources in properties that are not heated by boilers or furnaces using solid fuel or fuel oil.



## ID B3 Continued replacement of high-emission heat sources

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CB1, CB2, CB3
<b>Smart potential</b>		<b>Gender and economic inclusion potential</b>
<ul style="list-style-type: none"> <li>• Prioritising RES will contribute to the development of green industries and innovation in this field. It is important to consider the inclusion in the subsidy system of support for home energy storage from renewable energy sources and the development of innovation in this industry.</li> </ul>		<ul style="list-style-type: none"> <li>• Residents suffering from energy poverty will receive support from energy advisors who will help them to take advantage of municipal subsidies and combine them with other programs (e.g., "Clean Air", "Stop-Smog"). People affected by poverty, after taking advantage of subsidies and modernization of heating systems, will receive further support from the City, whether in the form of subsidies compensating for increased energy costs or the possibility of purchasing green electricity produced by the City.</li> <li>• Giving lower income people priority access to the replacement program for inefficient gas boilers</li> <li>• Organising extensive consultations with residents and social organisations, including anti-smog ones</li> </ul>

# Urban Planning and Blue-Green Infrastructure



## ID R1 Increasing biologically active surfaces and removing impermeable surfaces

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR2, CR3

### Description

The action is a response to the need to enlarge biologically active areas along with the improvement of the quality and accessibility of green areas, the protection of biodiversity and the development of blue - green infrastructure, both in whole neighborhoods and in individual green spaces. This will have a significant impact on climate change adaptation. There is potential to transform impermeable surfaces and introduce more biologically active areas in these places while ensuring its high quality - such activities can take place in squares, pavements, graveyards, some of the parking spaces and other impermeable areas. One possible solution could be to demolish the paving slabs or asphalted surface and greening the spaces in the squares, reconstruction of some squares currently used as parking spaces to make them available to everyone and use as recreational and representative spaces or green areas. Local food production (urban farming) could also be a potential area for development in the city.

The action will include, i.e., the modernisation of representative Warsaw squares, such as Constitution Square (2.53 ha), Bank Square (2.43 ha) or Teatralny Square (1.62 ha) and squares in district and local centres.

Designs should take into account the use of small architecture to ensure accessibility for all users and nature-based solutions and planting of urban tolerant plants.

An important element of the program would be to conduct information campaigns after the implementation of a given blue - green infrastructure facility to inform residents what the facility is for, why its installation is important for the urban environment and residents. The campaign will include workshops with residents. The action should be coordinated with the Integrated Territorial Investments Department (European Funds and Development Policy Department) in metropolitan cooperation.

### Background and justification

Blue-green infrastructure would bring many benefits to the city and its inhabitants by using existing spaces and transforming them into more livable environments. Proposed measure can be implemented in phases, depending on the availability of places and funding.

Changing their functions to green areas and other open areas with blue - green infrastructure would bring the following benefits for the city:

- direct – minimizing and slowing down the runoff of rainwater, counteracting the occurrence of flooding and preventing the formation of urban heat island effect in these areas;
- indirect - improving air quality by introducing more greenery in the city centre (calming traffic, greenery as a barrier to noise, increasing biodiversity in the city), increasing accessibility for residents to green spaces and recreation areas. The role of mature plants (trees) in terms of ecosystem services, including CO<sub>2</sub> sequestration and the need to compensate them appropriately if they are cut down, is also important.

### The scale of action / notes on the estimate

The scale of action is potentially very large considering the size of impervious surfaces across the city. Further studies - based on the city's Climate Change Adaptation Strategy - will be necessary to determine the technical and economic potential for implementation and to establish priority investment areas. The construction of a pocket parks in the capital city of Warsaw was also included in the action (such as rain gardens, retention basins and ditches).

## ID R1 Increasing biologically active surfaces and removing impermeable surfaces

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR2, CR3

### Cost calculation

- Based on: Transport-publiczny.pl, Budget of the Capital City of Warsaw 2021, Civic Budget of the Capital City of Warsaw, placewarszawy.pl, "Blue-green infrastructure to mitigate climate change in cities". Technical catalog - Ecologic Institute and Sendzimir Foundation 2019.
- Estimates of costs and unit prices are based on current tenders and projects falling within the scope of the current program of the Capital City of Warsaw called "Nowe Centrum Warszawy". The program consists in the modernization of city squares. Costs related to modernization of squares (including implementation of permeable surfaces, earthworks, planting new vegetation) was based on the cost of modernization of „Plac Pięć Rogów” with an area of 3 486 m<sup>2</sup> in the amount of over 14.756 million PLN (4.2 thousand PLN per m<sup>2</sup>). The estimated costs of capital expenditures relate to modernisation of the 3 squares indicated in the description of the action, with a total area of 6.58 ha. The cost of creating a pocket park was determined on the basis of the estimated costs of the Civic Budget (150,000 - 250,000 PLN). Costs of implementation of green roof, green facades and walls were determined on the basis of the above indicated report.

Operating costs were expressed as costs of; maintaining biologically active areas, which include mowing grass (1 378 PLN per 1 ha), costs of maintaining street greenery (2 937 PLN per 1 ha), maintenance costs of parks (3 108 PLN per 1 ha) and the cost of maintaining small architecture (the average annual cost of maintaining street equipment and devices in 104 parks (520 ha) located in the capital city of Warsaw - 120,000 PLN).<sup>59</sup>

### Financing mechanisms

- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.4 Support climate change adaptation and disaster risk prevention and resilience, taking into account the ecosystem approach.
  - CODE 60. Climate change adaptation and prevention and management of climate-related and other risks, e.g., torrential rainfall, storms and droughts (including awareness raising, civil protection and crisis management systems in case of natural disasters, infrastructure, ecosystem approach), 664 million EUR from Cohesion Fund grant, 42 million EUR from European Regional Development Fund grant for more developed regions.

- Objective 2.7: Nature protection and the preservation and enhancement of biodiversity, including in urban areas, and the reduction of all types of pollution.
  - CODE 79. Protection of nature and biodiversity, natural heritage and resources, blue - green infrastructure, 180 million EUR grants.
- Own funds of the City.

## ID R1 Increasing biologically active surfaces and removing impermeable surfaces

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR3, CR3

### Action owner

- Environmental Protection Department

### Bodies supporting the implementation of action

- Architecture and Spatial Planning Department
- Municipal Roads Authority
- Greenery management of the capital city of Warsaw
- Air Protection and Climate Policy Department
- Infrastructure Department
- European Funds and Development Policy Department
- Budget Planning Department

### Stakeholders

- Private enterprises
- Department of Real Estate Management
- City districts
- Public Land Management
- Property managers and property administrators
- Housing associations
- Local society
- NGOs (non-government organizations)

### Estimated savings

Management of rainwater and meltwater at the precipitation site may reduce the costs of removing the effects of floods and inundations 'at source' water management can reduce the cost of flooding (cleanup) and avoid the higher cost of expensive, traditional grey infrastructure for water management

### Estimated CO<sub>2</sub> emission reduction

Assuming the use of an indicator of 1.95 kg/CO<sub>2</sub>/m<sup>2</sup>/year for the greening of the indicated 6.58 ha area, will be 129.59 tCO<sub>2</sub>/year

### % reduction in GHG emissions compared to the 2018 inventory year

0.001%

### % of total CO<sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions

0.01%

## ID R1 Increasing biologically active surfaces and removing impermeable surfaces

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR3, CR3

Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
-	<p>Modernization of the 3 squares indicated in the description of the operation:</p> <ul style="list-style-type: none"> <li>• PLN 279 000 000</li> <li>• EUR 61 000 000</li> </ul> <p>Based on the average price for the modernization of large squares</p> <ul style="list-style-type: none"> <li>• PLN 4 200 per m<sup>2</sup></li> <li>• EUR 930 per m<sup>2</sup></li> </ul> <p>Establishing a pocket park</p> <ul style="list-style-type: none"> <li>• PLN 50 000 – 250 000</li> <li>• EUR 33 000 – 55 000</li> </ul> <p>Implementation of an extensive green roof</p> <ul style="list-style-type: none"> <li>• PLN 1 140 per m<sup>2</sup></li> <li>• EUR 250 per m<sup>2</sup></li> </ul> <p>Implementation of the intensive green roof</p> <ul style="list-style-type: none"> <li>• PLN 690 per m<sup>2</sup></li> <li>• EUR 50 per m<sup>2</sup></li> </ul> <p>Implementation of green facades and walls</p> <ul style="list-style-type: none"> <li>• PLN 14 600 per m<sup>2</sup></li> <li>• EUR 3 200 per m<sup>2</sup></li> </ul>	<p>Maintenance of the 3 biologically active areas indicated in the description of the operation of the squares</p> <ul style="list-style-type: none"> <li>• PLN 486 400</li> <li>• EUR 106 500</li> </ul> <p>Maintenance of biologically active surfaces</p> <ul style="list-style-type: none"> <li>• PLN 7,40 per m<sup>2</sup></li> <li>• EUR 1,60 per m<sup>2</sup></li> </ul> <p>Maintenance of small architecture</p> <ul style="list-style-type: none"> <li>• PLN 231 per 1 ha</li> <li>• EUR 50 per 1 ha</li> </ul>

## ID R1 Increasing biologically active surfaces and removing impermeable surfaces

Timescale	Type of action	Short-term objectives of the GCCAP						
2023–2030	Capital program	CR1, CR3, CR3						
<b>Steps of implementation</b>	<b>Timeline</b>							
	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>	<b>2030</b>
Organization of the task implementation process, including: assigning new tasks to individual cells / units, acquiring human resources								
Analysis of the location and identification of areas requiring increased biologically active surface and those most at risk of degradation of biologically active surfaces								
Obtaining financing								
Execution of the investment: design and construction work								
Constant monitoring of the most urbanized areas in terms of the development of biologically active areas (every 3 years)								
Conducting an educational and information campaign after the implementation of a given blue - green infrastructure element								
<b>Product indicator</b>	<b>Result indicator</b>							
<ul style="list-style-type: none"> <li>Area of impervious land converted to biologically active surface</li> </ul>	<ul style="list-style-type: none"> <li>Number and retention capacity of implemented rainwater and meltwater retention solutions</li> </ul>							

## ID R1 Increasing biologically active surfaces and removing impermeable surfaces

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR3, CR3
<b>Action benefits</b>		
<ul style="list-style-type: none"> <li>• Increasing and protection of green areas</li> <li>• Climate change resilience, including reducing the risk of flooding, slowing water runoff, and improving air quality comfort</li> <li>• Improving the functioning of the stormwater and combined sewerage networks and their relief through the use of Blue-Green Infrastructure elements</li> <li>• Increasing the availability of green areas for residents</li> <li>• Reducing the energy required to cool rooms in buildings</li> <li>• Improvement of phytosanitary conditions</li> <li>• Increase in property value</li> <li>• Reduction in air pollution</li> <li>• Regulation and improvement of the microclimate</li> <li>• Creating friendly places for recreation and relaxation for the residents of Warsaw and the surrounding area</li> <li>• Expansion and diversification of the urban ecosystem</li> <li>• Increasing the tourist attractiveness of the area</li> <li>• Enhancing the aesthetic qualities of a highly urbanised area</li> <li>• Improving the quality of life of residents</li> </ul>		
<b>Enabling actions within the Green City and Climate Action Plan of Warsaw</b>		<b>Enabling policies and actions</b>
<ul style="list-style-type: none"> <li>• PS1 Education campaigns</li> <li>• R4 Greening streets</li> </ul>		<ul style="list-style-type: none"> <li>• Climate change adaptation strategy for the Capital City of Warsaw by 2030 with a perspective by 2050</li> <li>• Strategy # Warsaw2030</li> <li>• Environmental protection program of the Capital City of Warsaw for the years 2021-2024</li> <li>• Warsaw Climate Panel (recommendation: Remove impermeable surfaces and increasing the share of biologically active surfaces in built-up areas through incentives for owners and managers of private real estate, cooperation and joint ventures with managers of public real estate not managed by the City)</li> <li>• Study of the conditions and directions of spatial development for the Capital City of Warsaw</li> </ul>



## ID R1 Increasing biologically active surfaces and removing impermeable surfaces

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR3, CR3

Smart potential	Gender and economic inclusion potential
<ul style="list-style-type: none"> <li>• Implementation of an intelligent sewage model,</li> <li>• Implementation of new technologies for qualitative and quantitative monitoring of biologically active surfaces (retention, humidity, temperature, gas and dust absorption).</li> </ul>	<ul style="list-style-type: none"> <li>• Projects taking into account the needs of various social groups and the safety of moving around the modernized areas.</li> <li>• Emphasise the planning of these spaces for the mobility and recreation of pedestrians, cyclists, disabled people, people using wheelchairs, and people with prams, scooters, the elderly, and children. It is also necessary to ensure good communication of these areas by public transport.</li> <li>• Universal design principles should be applied to new developments and site upgrades.</li> <li>• Ensuring equal access for women to green jobs - that is, those related to the transformation of existing spaces into more life-friendly and biodiverse.</li> </ul>

## ID R2 Protection and restoration of valuable green areas

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR2, CR3

### Description

Implementation of the program aimed at supporting activities including protection against loss of valuable areas and then involving greening and restoration of the main natural areas of the city. Purchase and lease of valuable natural land, protection of valuable green areas and other key open areas, forests and wetlands, renaturalisation of watercourses.

The program will include activities for:

- increasing and preserving biodiversity (meadow areas; native species of flora and fauna) through the purchase of land,
- establishing forms of nature protection at the discretion of the city,
- conducting regular monitoring of naturally valuable areas in terms of the quality of these areas,
- protection of the hydrographic system,
- renaturalisation of aquatic ecosystems, including watercourses,
- increasing public access to green areas and other open areas along with conducting educational activities in the protection of these areas (in relation to non-public land).

### Background and justification

Access to green areas, open areas, and water ensures a better quality of life and well-being for residents by ensuring a high-quality environment in which people live every day. Additionally, increasing the number of green areas in the city can have a positive effect on the mental and physical health of the inhabitants. Green areas support protection against climate change and ecological disasters, e.g., by trapping carbon dioxide and preventing soil erosion. Natural areas support adaptation to climate change, help to improve air quality and the microclimate of the city. Restoring connections of previously isolated natural areas helps to increase within the city's biodiversity and improve the mobility of organisms. Stimulating wise and integrated development ensures effective and consistent use of the limited space of the city.

### The scale of action / notes on the estimate

- The measure concerns the identification of naturally valuable areas in the area of the Capital City of Warsaw, which have not been fully legally protected.

- Undertaking activities ensuring the protection of naturally valuable areas, through purchase, covering with a form of protection or planning.
- Organization in the annual budget of funds for the purchase of naturally valuable land. Actions taken on one of the purchased land - the cost of the pilot project assumes the improvement of the biodiversity of the area.
- The measure should also place emphasis on the monitoring of designated areas of natural value in the Capital City of Warsaw. Environmental monitoring (qualitative and quantitative), carried out in a cycle of tests every 3 years, should cover both fauna: habitats and the existence of mammals, amphibians, reptiles, birds, and flora: plants, fungi, lichens, plant communities and the area / number of valuable areas naturally. As part of the monitoring, naturalists will conduct a field analysis and report on research. This action should consist in supporting the Warsaw Index of Biological Diversity.

## ID R2 Protection and restoration of valuable green areas

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR2, CR3

### Cost calculation

- Based on: Budget of the Capital City of Warsaw 2021, Budget of the Capital City of Krakow 2020, Management of Greenery of the Capital City of Warsaw, Arup Benchmarks.
- Pre-investment costs of the preparation of the pilot land development program estimated on the basis of the public procurement for the preparation of design documentation for the revitalization of the Warsaw Gwary Square in 2019. The capital expenditure was estimated on the basis of the actual expenditure of the city of Krakow to maintain or expand the city's naturally functioning areas in 2020. Kraków allocated over 172 million PLN for this purpose, which accounted for 2.5% of all expenditure in the city's budget for 2020.<sup>60</sup> Relating this cost proportionally to the expenses of the Warsaw budget (over 21.6 billion PLN), the amount for the purchase of naturally valuable areas is over 540 million PLN.

The cost of developing a multi-branch technical concept for the implementation of the restoration project for selected sites has been estimated on the basis of a public tender for the development of a multi-branch technical concept for the implementation of the restoration project for water bodies, together with obtaining decisions and permits for the construction of dams on ditches or their adaptation in 2020 in Warsaw.<sup>61</sup>

- Operating costs have been estimated based on the budget of the city of Warsaw in 2021. The average cost of mowing 1 ha of land was 1,378 PLN. The costs of environmental monitoring have been estimated by the Consultant.

### Mechanizmy finansowania

- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.7: Enhancing nature protection and conservation, biodiversity, including in urban areas, and reducing pollution of all kinds
  - CODE 78. Protection, regeneration, sustainable use of Natura 2000 sites, 120 million EUR grants
  - CODE 79. Protection of nature and biodiversity, natural heritage and resources, blue - green infrastructure, 180 million EUR of grants
- NFOŚiGW (National Fund for Environmental Protection and Water Management)
- Own funds of the City

## ID R2 Protection and restoration of valuable green areas

Timescale	Type of action	Short-term objectives of the GCCAP		
2023–2030	Capital program	CR1, CR2, CR3		
<b>Action owner</b>				
<ul style="list-style-type: none"> <li>Environmental Protection Department</li> </ul>				
<b>Bodies supporting the implementation of action</b>				
<ul style="list-style-type: none"> <li>Greenery management of the capital city of Warsaw</li> <li>Architecture and Spatial Planning Department</li> <li>Air Protection and Climate Policy Department</li> <li>City and State Treasury Property Department</li> <li>European Funds and Development Policy Department</li> <li>Budget Planning Department</li> <li>Warsaw City Forests</li> <li>City districts</li> </ul>				
<b>Stakeholders</b>				
<ul style="list-style-type: none"> <li>Departments of capital city of Warsaw</li> <li>Private and municipal enterprises</li> <li>Local community</li> <li>NGOs associated with the protection of greenery and activities for sustainable development</li> </ul>				
<b>Pre-investment (PLN, EUR)</b>		<b>CAPEX (PLN, EUR)</b>	<b>OPEX (PLN, EUR)</b>	
Legal framework development study <ul style="list-style-type: none"> <li>PLN 350 000</li> <li>EUR 76 600</li> </ul>		2.5% of the city's annual budget (as of 2021): <ul style="list-style-type: none"> <li>PLN 541 000 000</li> <li>EUR 118 000 000</li> </ul>	Moving the grass <ul style="list-style-type: none"> <li>PLN 1 400 per 1 ha</li> <li>EUR 300 per 1 ha</li> </ul> Environmental monitoring <ul style="list-style-type: none"> <li>PLN 550 000 per year</li> <li>EUR 121 000 per year</li> </ul>	
Pilot land development program: <ul style="list-style-type: none"> <li>PLN 200 000</li> <li>EUR 44 000</li> </ul>		The cost of developing a multi-branch technical concept for the implementation of the restoration project for selected sites: <ul style="list-style-type: none"> <li>PLN 1 300 000</li> <li>EUR 285 000</li> </ul>		
<b>Estimated savings</b>		<b>Estimated CO<sub>2</sub> emission reduction</b>	<b>% reduction in GHG emissions compared to the 2018 inventory year</b>	
-		Preserving and increasing the share of areas with CO <sub>2</sub> absorbing properties	-	

## ID R2 Protection and restoration of valuable green areas

<b>Timescale</b>	<b>Type of action</b>	<b>Short-term objectives of the GCCAP</b>
2023–2030	Capital program	CR1, CR2, CR3

<b>Steps of implementation</b>	<b>Timeline</b>							
	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>	<b>2030</b>
Organization of the task implementation process, including: assigning new tasks to individual cells / units, acquiring human resources								
Analysis and designation of naturally valuable areas that should be included in the land purchase program								
Budgetary provision for implementation of the action								
Implementation of the annual purchase of naturally valuable land for the city								
Conducting a pilot project for one of the purchased areas. As part of the pilot project, it is planned to implement a project aimed at increasing the quality of green areas and biodiversity, project implementation, educational programmes, cooperation with the local community								
Creating an implementation mechanism and rules for conducting regular qualitative and quantitative monitoring of green areas and areas of natural value for the city								
Conducting regular monitoring works in the city every 3 years								

<b>Product indicators</b>	<b>Result indicators</b>
<ul style="list-style-type: none"> <li>The area of the purchased land of natural value</li> </ul>	<ul style="list-style-type: none"> <li>Increase in the value of the selected biodiversity indicator, in line with the Warsaw Index of Biological Diversity</li> </ul>

## ID R2 Protection and restoration of valuable green areas

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR2, CR3

### Action benefits

- Increasing the area and ensuring the protection of naturally valuable areas
- Increasing biodiversity
- Preservation and restoration of the hydrographic system
- Raising environmental knowledge and awareness
- Increased resilience to climate change
- Increased access to areas of natural value for residents
- Safer public spaces and green spaces that take into account the needs of gender, people with reduced mobility, sexual and ethnic minorities

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- R3 Preservation & restoration of urban greenery Zakole Wawerskie
- PS1 Education campaigns

### Enabling policies and actions

- Climate change adaptation strategy for the Capital City of Warsaw by 2030 with a perspective by 2050
- Strategy #Warsaw2030
- Environmental protection program of the Capital City of Warsaw for the years 2021-2024

## ID R2 Protection and restoration of valuable green areas

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR2, CR3

Smart potential	Gender and economic inclusion potential
<ul style="list-style-type: none"> <li>Implementation of a coherent biodiversity monitoring system.</li> </ul>	<ul style="list-style-type: none"> <li>Ensuring the safe use of open areas by residents through appropriate lighting, monitoring system, alarm systems taking into account the gender perspective and the needs of groups particularly vulnerable to violence in urban space.</li> <li>Emphasis in planning for the mobility of pedestrians, cyclists, people with disabilities, including those using wheelchairs and people with prams, people on scooters, the elderly and children.</li> <li>As part of new investments and modernization of areas, the principles of universal design should be applied.</li> </ul>

## ID R3 Preservation & restoration of urban greenery Zakole Wawerskie

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR2, CR3

### Description

Protect valuable green areas and other key open areas, in particular wetlands such as the areas of the Zakole Wawerskie, through implementation of appropriate protection against development and allocation of funds for the lease and purchase of land within the wetlands. Action is to protect nature areas against further urbanization pressure which will take place in parallel with the process of creating and adopting MPZP in this area. The measure will support the protection of urban wetland, the aim of which would be water retention, protection of biodiversity, climate, and air.

It is an important action for the protection of the valuable area of Zakola Wawerskie, and at the same time a pilot action, constituting a step in setting out recommendations for future actions for the protection of valuable natural wetland areas within the city, which are exposed to urbanization pressure. More areas of the city should be covered by similar actions in the future.

### Background and justification

Access to green areas and surface waters has a positive impact on the quality of life of the population and has a direct impact on the environment.

The identified areas can contribute to improving air quality and even regulate air temperature in the city.

In addition, they can reduce the risk of flooding as vegetated surfaces have a high capacity to absorbing and storing water. It should also be noted that the area is a peat bog, which is especially important due to the storage of water and carbon.

The Zakole Wawerskie is a vast wetland that is subject to constant urbanisation pressure.

Currently, work is being carried out on the local land use plan, which covers the Zakole Wawerskie.

Drainage of wetlands is one of the factors accelerating global warming, as it causes rapid oxidation of the carbon contained in the peat and its emission to the atmosphere in the form of carbon dioxide. The drying of peat contributes to the release of greenhouse gases (mainly CH<sub>4</sub> and CO<sub>2</sub>)<sup>58</sup>.

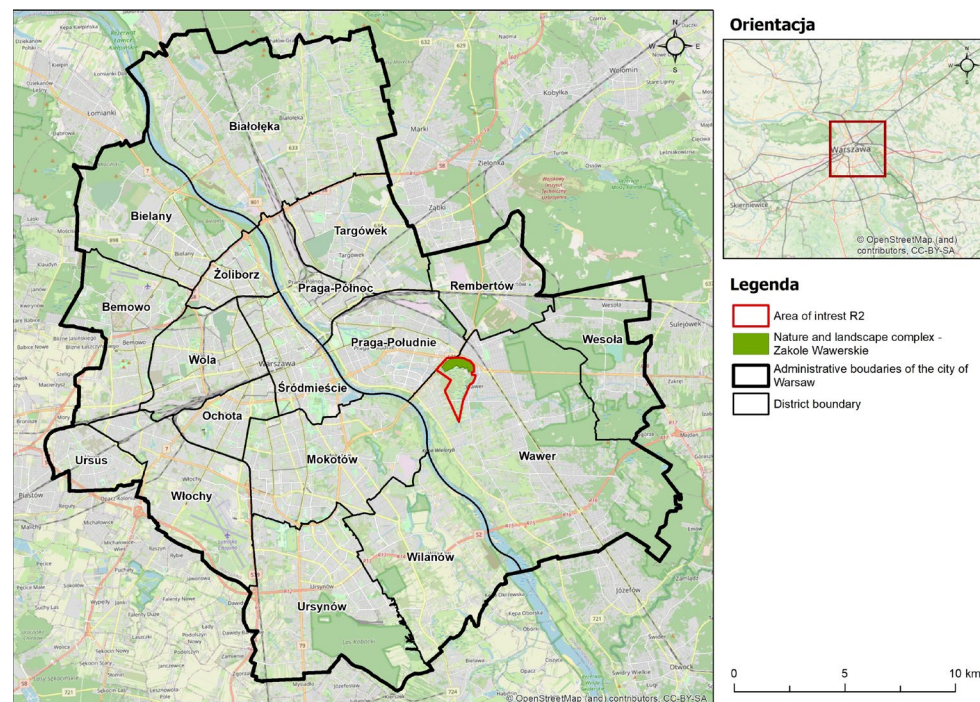


Figure 14. Area of interest R3



## ID R3 Preservation & restoration of urban greenery Zakole Wawerskie

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR2, CR3

### The scale of action / notes on the estimate

The costs have been estimated based on the document "Financial Impact Forecast for the Adoption of Zakole Wawerskie Local Land Use Plan and the Kadetów Street area". Implementation of this action will require in-depth analysis and research, collection of relevant data, local inspections and consultation with experts. Funding for this has been provided as nature monitoring in another dedicated action, more broadly covering the protection of valuable natural areas across the city.

### Cost calculation

- Based on: Architecture and Spatial Planning Office of the Capital City of Warsaw, Budget of the Capital City of Warsaw, 2021
- The estimated amount shows the cost related to the adoption and implementation of local spatial development plans for approximately 80 ha of Wawerski Zakole and approximately 85 ha of the area of Kadetów<sup>59</sup> Street and purchase of land intended for public purposes at the average price (depending on the type of plot) 98 PLN per m<sup>2</sup> or 207 PLN per m<sup>2</sup>.

The amount of repurchase of the area of Zakole Wawerskie includes: the cost of purchase of land located on the lines separating public purpose investments – 79 million PLN, costs of compensation for the decline in property value - 10.7 million PLN, construction of road infrastructure - 1.5 million PLN, construction of infrastructure technical - 805 thousand PLN, construction of squares and pedestrian routes in landscaped green areas - 477 thousand PLN, costs related to the payment of compensation for buildings located on the lines delimiting the area of 4.ZP and in the event of the necessity to pay compensation for land located on the lines delimiting the Olszynka Grochowska Route - 10.25 million PLN.

- In the amount of land purchase in the area of Kadetów Street includes: the cost of purchase of land located on the lines separating public purpose investments – 80.1 million PLN, construction of road infrastructure - 710 thousand PLN, construction of technical infrastructure – 400 thousand PLN and construction of a cultural services facility and pedestrian paths in landscaped green areas - 40.23 million PLN.

- The costs of maintaining the land were estimated on the basis of the average costs of maintaining 1 ha of the park (3 108 PLN).

### Financing mechanisms

- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.7: Enhancing nature protection and conservation, biodiversity, including in urban areas and reducing pollution of all kinds
  - CODE 78. Protection, regeneration, sustainable use of Natura 2000 sites, 120 million EUR grants
  - CODE 79. Protection of nature and biodiversity, natural heritage and resources, blue – green infrastructure, 180 million EUR of grants

## ID R3 Preservation & restoration of urban greenery Zakole Wawerskie

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR2, CR3

### Financing mechanisms cont.

- NFOŚiGW (National Fund for Environmental Protection and Water Management)
- Own funds of the City
- Revenues from an increase in property taxes, from a planning fee, from an adiacen fee (revenue for the municipality due to an increase in the value of the property) and from a tax on civil law transactions.

### Action owner

- Environmental Protection Department

### Bodies supporting the implementation of action

- Architecture and Spatial Planning Department
- Air Protection and Climate Policy Department
- Wawer District Office
- City and State Treasury Property Department
- Warsaw City Forests
- Budget Planning Department
- European Funds and Development Policy Department

### Jednostki współpracujące

- Local society
- NGOs (non-government organizations)
- Regional Directorate for Environmental Protection.

Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
-	PLN 224 172 000	PLN 6 200 000
	EUR 49 100 000	EUR 1 350 000
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
-	-	-
% of total CO <sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions		
-		

## ID R3 Preservation & restoration of urban greenery Zakole Wawerskie

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR2, CR3

Steps of implementation	Timeline							
	2023	2024	2025	2026	2027	2028	2029	2030
Organization of the task implementation process, including: assigning new tasks to individual cells / units, acquiring human resources								
Taking appropriate actions to enable the area to be protected: planning procedure, establishing a form of nature protection, purchase								
Budgetary security for the implementation of the action								
Conducting a pilot project in the purchased areas of the Zakole Wawerskie. As part of the pilot project, it is planned to implement a project aimed at increasing the quality of green areas and biodiversity, project implementation, educational programmes, cooperation with the local community								
Conducting regular monitoring works (detailed in the R2 action)								

Product indicators	Result indicators
<ul style="list-style-type: none"> <li>The area of protected fragments of the Zakole Wawerskie</li> </ul>	<ul style="list-style-type: none"> <li>Increase in the value of the selected biodiversity indicator, in line with the Warsaw Index of Biological Diversity</li> </ul>

## ID R3 Preservation & restoration of urban greenery Zakole Wawerskie

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR2, CR3
<b>Action benefits</b>		
<ul style="list-style-type: none"> <li>Increasing the biodiversity in the city</li> <li>Increasing and / or protection of green areas</li> <li>Protection against increasing emissions due to the loss of environmentally valuable areas</li> <li>Increased resilience to climate change</li> <li>Creation of a friendly place of recreation and relaxation for the inhabitants of the city and the surrounding area</li> <li>Increasing the tourist attractiveness of the area</li> <li>Reduced risk of flooding</li> <li>Increased available green space for residents</li> <li>Regulating and improving the microclimate</li> <li>Public involvement</li> <li>Enrichment of the urban ecosystem</li> </ul>		
<b>Enabling actions within the Green City and Climate Action Plan of Warsaw</b>		<b>Enabling policies and actions</b>
<ul style="list-style-type: none"> <li>PS1 Education campaigns</li> <li>R3 Preservation &amp; restoration of urban greenery Zakole Wawerskie</li> </ul>		<ul style="list-style-type: none"> <li>Newly developed and in force: Study of the Conditions and Directions of Spatial Development of Warsaw</li> <li>Environmental protection program of the Capital City of Warsaw</li> <li>Strategy #Warsaw2030</li> <li>Strategy of adaptation to climate change for the Capital City of Warsaw until 2030 with a perspective until 2050. Urban Adaptation Plan</li> </ul>

## ID R3 Preservation & restoration of urban greenery Zakole Wawerskie

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CR1, CR2, CR3

Smart potential	Gender and economic inclusion potential
<ul style="list-style-type: none"> <li>• A coherent monitoring system for biodiversity under the R2 action,</li> <li>• A coherent system of surface water management and rainwater storage capacity during heavy rainfall, hydrological modelling.</li> </ul>	<ul style="list-style-type: none"> <li>• Ensuring the safety of using the target nature park (or Landscape-Nature Protected Complex) by residents, taking into account the gender perspective and the needs of groups particularly vulnerable to violence in urban space.</li> <li>• Emphasis in planning for the mobility of pedestrians, cyclists, disabled people, including those using wheelchairs and people with prams, people on scooters, the elderly, and children.</li> <li>• As part of new investments and modernization of areas, the principles of universal design should be applied.</li> </ul>

## ID R4 Greening streets

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CR1, CR2, CT2, CT4
<p><b>Description</b></p> <p>Implementation of the action program for the reconstruction of streets along with their greening, aimed at users of public transport, pedestrians, and cyclists.</p> <p>Ensuring the coherent development of the bicycle road system with the planning of the implementation of bicycle <i>velostrad</i> and the implementation of bus lanes, to favor public transport, pedestrian, and bicycle traffic. Increasing the safety of pedestrians within bicycle paths, streets, and roads. The implemented solutions and the implementation process will be agreed upon with the local community.</p> <p>As part of the project, it is expected:</p> <ul style="list-style-type: none"> <li>planting trees,</li> <li>construction of bicycle paths, lanes or paths for bicycles (bicycle is a means of transport equivalent to urban or individual car transport, not a recreational one),</li> <li>introduction of nature-based solutions for the sustainable management of rainwater (infiltration basins, rain gardens in road lanes and at crossings for pedestrians),</li> <li>creating of conditions for biodiversity in road lanes,</li> <li>development of permeable pavements,</li> </ul>	<ul style="list-style-type: none"> <li>introducing of intelligent elements of small architecture with the function of notifying about emergencies, adapted to the needs of disabled people,</li> <li>expanding bus lanes enabling fast travel on roads with high traffic, within the city and connecting the city with the suburbs.</li> </ul> <p>The indicated solutions will make it possible to combine the functions of car traffic and parking in the streets with pedestrian routes, bicycle traffic and recreation areas, as well as blue-green infrastructure serving, among others, relieving storm drain and combined sewage systems</p> <p>The action should be coordinated with the Integrated Territorial Investments Department (European Funds and Development Policy Office) in metropolitan cooperation.</p> <p><b>Background and justification</b></p> <p>The program should provide for sustainable and universal design of public spaces, taking into account the needs of all users and functions: public transport (prioritisation of public transport), individual transport, parking, walking, cycling and recreation. Changes in road infrastructure will influence car users and encourage them to change travel mode choices.</p>	<p>There is a need to implement an integrated system of bicycle paths, eliminating the shortcomings of the existing system and 'bottlenecks' by combining the elements of the existing system, increasing its coherence. The action will include a functional system of transport corridors where increased user interest is expected.</p> <p>The exemplary locations were selected based on the 'New Warsaw Centre' programme. The city should introduce this measure in as many streets as possible.</p> <p><b>The scale of action / notes on the estimate</b></p> <p>The „New Centre of Warsaw” Program, taking into account the reconstruction and modernization of the streets indicated below:</p> <ul style="list-style-type: none"> <li>Avenue Jana Pawła II – 700 m,</li> <li>Chmielna Street – 730 m,</li> <li>Marszałkowska Street – 2500 m,</li> <li>Avenue Jerozolimskie – 1500 m,</li> <li>Krucza Street – 850 m.</li> </ul> <p>The implementations should be steadily introduced in the entire basic network of public spaces indicated in the new Study of Conditions and Directions for Spatial Development, including within the Green Rings.</p>

## ID R4 Greening streets

Ramy czasowe

2023–2029

Typ działania

Capital program

Krótkoterminowe cele Zielonej Wizji Warszawy

CR1, CR2, CT2, CT4

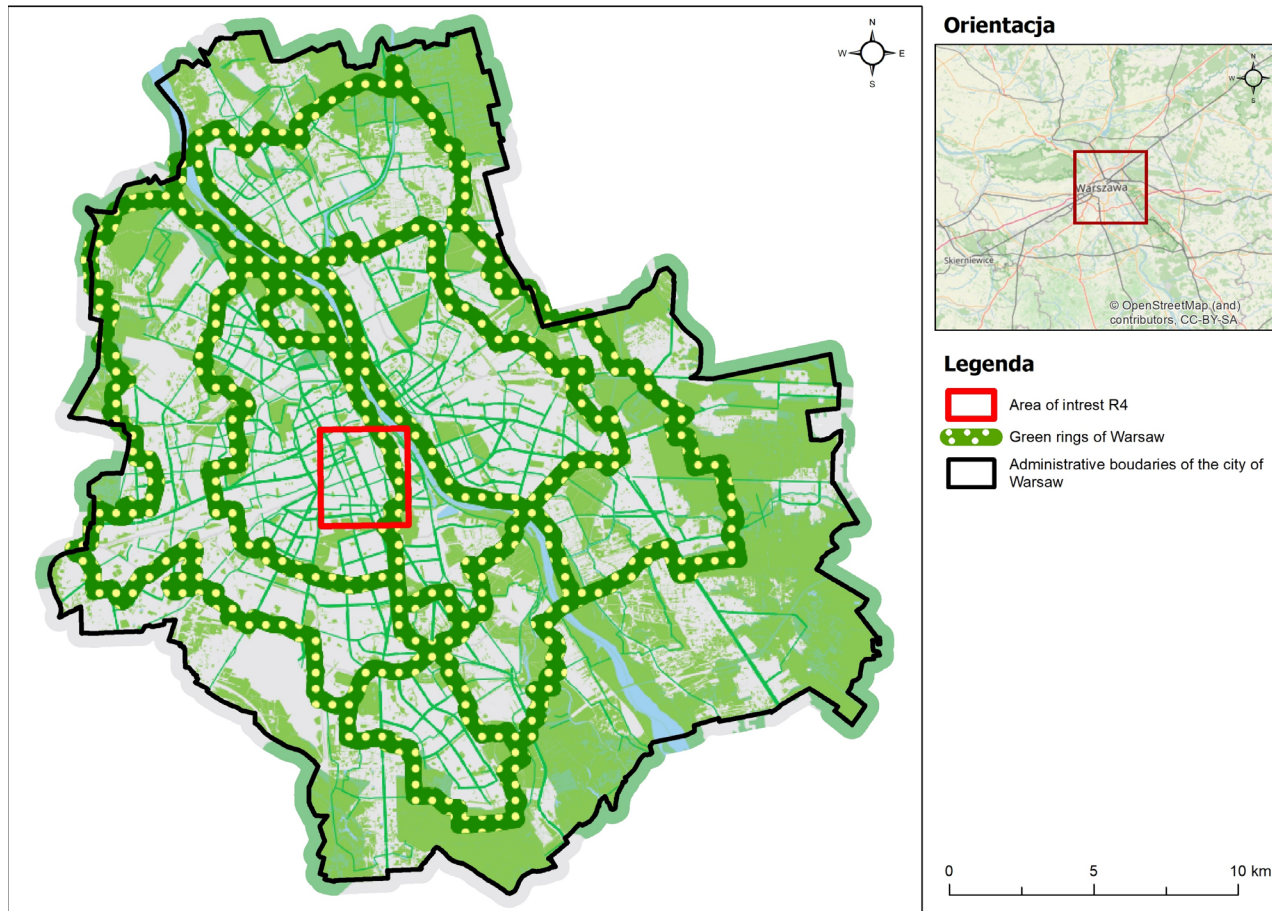


Figure 15. The scope of R4 action against the background of the designed blue-green infrastructure system of Warsaw

### Cost calculation

- Based on: Public procurement of the Capital City of Warsaw, Transport-publiczny.pl, Reduction of air pollutant emissions in the municipalities of the south-western part of the Warsaw Functional Area by building the Integrated System of Bicycle Routes - Stage III, budget of the Capital City of Warsaw 2021.
- The capital expenditure was determined on the basis of the modernization costs of Aleja Jana Pawła II (700m) and Rondo Czterdziestolatka in the amount of over 18 million PLN. The amount presented is the proportional cost of modernization of the "New Center of Warsaw", with a total length of 6.28 km. Operating costs determine the cost of maintaining a new road section and renovating new roads (6.28 km). In the budget of the Capital City of Warsaw in 2021, the expenditure for this purpose amounted to over 66 million PLN (repairs on a total section of over 790 km). On this basis, the cost of road maintenance and repair was estimated at 83.7 thousand PLN per 1 km.

## ID R4 Greening streets

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CR1, CR2, CT2, CT4

### Cost calculation cont.

The cost of creating green rings in the city was estimated on the basis of the contract for the implementation of the project entitled Reduction of air pollutant emissions in the municipalities of the south-western part of the Warsaw Functional Area through the construction of the Integrated System of Bicycle Routes - Stage III, which included the construction of 11.31 km of bicycle paths with accompanying infrastructure, including lighting, pavements, pedestrian and bicycle bridges, self-service points, separators, supports and bicycle stands. The value of the project was estimated at PLN 24,235,884.29 (EUR 5,307,000), which is approx. PLN 2,143,000 (EUR 470,000) per one kilometer of the new investment. The estimated amount was increased by an additional PLN 50,000 PLN (11 thousand EUR) for planting greenery around the newly built pedestrian and bicycle route.

Pre-investment costs are the costs of developing documentation related to the implementation and the possibility of realisation green rings in Warsaw.

### Financing mechanisms

- Recovery and Resilience Facility
  - B3.4.1. Investments for the comprehensive green transformation of cities, 2800 million EUR in loans
- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.7: Enhancing nature protection and conservation, biodiversity, including in urban areas, and reducing pollution of all kinds
    - CODE 78. Protection, regeneration, sustainable use of Natura 2000 sites, 120 million EUR grants
    - CODE 79. Protection of nature and biodiversity, natural heritage and resources, blue - green infrastructure, 180 million EUR of grants
- Own funds of the City
- NFOŚiGW (National Fund for Environmental Protection and Water Management)

### Action owner

- **Municipal Roads Authority**

### Bodies supporting the implementation of action

- The Board of Greenery of the capital city of Warsaw
- City districts
- Architecture and Spatial Planning Department

### Stakeholders

- Department for European Funds and Development Policy
- Private and municipal enterprises
- Local community
- NGOs related to the protection of greenery, urban mobility and sustainability



## ID R4 Greening streets

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CR1, CR2, CT2, CT4
Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
650 000 PLN	Modernization of streets with a total length of over 6.28 km	PLN 526 000
142 000 EUR	PLN 162 200 000	EUR 115 000
	EUR 35 500 000	
	Creation of Green Rings in the city at 1 km	
	PLN 2 193 000	
	EUR 480 000	
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
-	Tree planting: 12 tCO <sub>2</sub> /year (based on proposed streets with 347 trees/km and a savings of 2 Mg/year per km)	0.05%
	Traffic reduction: 6 000 tCO <sub>2</sub> /year (based on reduction of traffic by 1,000 passenger vehicles per hour)	
% of total CO <sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions		
0.50%		

## ID R4 Greening streets

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CR1, CR2, CT2, CT4

Steps of implementation	Timeline						
	2023	2024	2025	2026	2027	2028	2029
Development of the scope and schedule of activities							
Development of a detailed concept of the Green Rings with an analysis of the land ownership status							
Preparation of construction and working designs along with obtaining the necessary permits for the implementation of the investment							
Selecting a contractor for construction works for construction investments							
Carrying out construction works for the implementation of the investment							

Product indicators	Result indicators
<ul style="list-style-type: none"> <li>the number and area of tree and shrub plantings and rain gardens created and retention basins made, ensuring reduced rainwater run-off,</li> <li>increase of the overall length of bicycle paths in the road space, ensuring the safety of pedestrians,</li> <li>increase in the length of the mileage of new bus lanes in the reconstructed carriageway lanes.</li> </ul>	<ul style="list-style-type: none"> <li>% of reduction of air pollution by reducing car traffic and introducing green areas</li> </ul>

## ID R4 Greening streets

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CR1, CR2, CT2, CT4

### Action benefits

- Improving the safety of pedestrians and cyclists
- Improving the convenience of connections for public transport and cycling
- Increasing the area of green areas
- Increased biodiversity in the city
- Increased resilience to climate change, incl. flood risk reduction and thermal comfort enhancement
- Improvement of the sewage and rainwater network, with priority for the construction of a separate rain and sanitary sewage system
- Improved management of rainwater and meltwater
- Reduced risk of flash flood
- Decreased sewer overflow events
- A space that encourages walking and cycling (bicycle is a means of transport equivalent to urban or individual car transport, not a recreational one)
- Encourage the use of public transport
- Safer streets taking into account the needs of different social and ethnic groups, depending on the gender, age, and specification of different user groups
- Space for the development of the civic community
- Developing the knowledge of residents about the benefits of switching from individual to collective transport, more frequent use of bicycles and walking, and the importance of this process for the implementation of the idea of a green, sustainable city.

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- T5 Research on public transport needs
- PS1 Education campaigns
- T2 Convenient and safe zero-emission public transport

### Enabling policies and actions

- "Strategy of adaptation to climate change for the Capital City of Warsaw by 2030 with a perspective by 2050"
- Strategy #Warsaw2030
- Environmental Protection Program for the Capital City of Warsaw for 2021-2024
- New Centre of Warsaw
- A new Study of the conditions and spatial development of the Capital City of Warsaw
- Sustainable Mobility Program

## ID R4 Greening streets

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CR1, CR2, CT2, CT4

Smart potential	Gender and economic inclusion potential
<ul style="list-style-type: none"> <li>• The opportunity to leverage the ATMS system of the city to optimize the design and implementation of this action (priority to public transport, bicycle lanes, for instance).</li> <li>• Further development of the system of renting bicycles and electric scooters</li> <li>• Optimization of operations by tracking maintenance teams/vehicles</li> </ul>	<ul style="list-style-type: none"> <li>• When planning solutions for the needs of transport and recreation, the needs in this respect should be taken into account in terms of gender, age, and specificity of excluded groups (e.g., ethnic minorities). Particular attention should be paid here to the safety requirements.</li> <li>• As part of new investments and modernization of areas, the principles of universal design should be applied.</li> </ul>

# Transport



## ID T1 Continued expansion of municipal integrated rail transport

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2032	Capital program	CT1, CT2, CT3, CT4, CT5

### Description

Strengthen and accelerate current actions aimed at developing integrated urban rail transport (metro, tram, suburban railway).

Construction of the second metro line is nearing completion. Preparatory work is underway to extend the 1st metro line with two new stations: Plac Konstytucji and Muranów and the construction of the 3rd metro line on the section from the National Stadium station to the Gocław housing estate in the Praga Południe district.

A tram line in Tarchomin with a temporary tram terminus was put into operation and the construction of a tram line in Wola (along Kasprzaka Street) was started.

A contract was also signed with the contractor selected in the tender for the construction:

- tram line to Wilanów - on the section from the intersection of ul. Puławska, Rakowiecka and Goworka to the intersection of al. Rzeczpospolita with ul. Branicki,
- a new tram depot in Annapol.

Preparatory works related to the implementation of the following tram routes are also carried out:

- completion of the construction of the tram to Wilanów towards the west, i.e., to the West Railway Station via ul. Rostafiński, Banach and the Battle of Warsaw,
- construction of a new route to Gocław, Zielona Białołęka and along ul. Modlińska.

A new tram route is planned to Gocław, Zielona Białołęka, along Modlińska Street and to complete the connection to Wilanów and Tarchomin.

The city is also carrying out many works related to the improvement of the PTZ traffic conditions in Warsaw - existing tram lines are being modernized, more and more green tracks appear, bus stop shelters are replaced, a passenger information network is developed (e.g. displaying information about the departure times of trains, trams and buses from the nearest stop in means of transport), and priority is given to passing through intersections not only to buses, but also to trams.

In the technological process of rail transport, an important issue is to reduce the service trips of rolling stock to the railway siding for parking and to create the possibility of safely parking rolling stock at turning stations in order to save electricity consumption.

The commencement of the implementation of the provisions of this action requires a detailed analysis of the needs of public transport users and the possibility of building a network of rail transport connections and transfer stations in densely populated suburbs.

This will result in ensuring a quick connection of the city center with the peripheral areas of Warsaw districts. The process of these changes will be facilitated by Transit Oriented Development (TOD), which will help to maximize the value of investment in infrastructure and may result in reducing the need for individual vehicles by suburban residents.

Analysis of the needs and possibilities of the connection between Warszawa Wschodnia - Warszawa Gdańska as well as field conditions that affect the operation of railway lines and the connection to the north.

Existing rail network functioning and influence on environment should be examined for better planning of new investments.

The activities carried out will take into account the provisions of the strategic document Sustainable Urban Mobility Plan for the Warsaw Metropolis.

## ID T1 Continued expansion of municipal integrated rail transport

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2032	Capital program	CT1, CT2, CT3, CT4, CT5

### Background and justification

The integration of suburban rail connections with tram and metro transport, while replacing the used rolling stock with modern ones, is a key factor encouraging residents to leave their car at home and take advantage of the wide offer of public transport. The expansion and integration of public rail transport will increase comfort and reduce travel time from areas with fewer connections to the city centre. There are currently ongoing tramway projects in Warsaw with a total cost of over PLN 1.67 billion. Transport services will become more efficient and attractive to users. Changes to user travel patterns may have a possible positive impact in reducing pollution and greenhouse gas emissions.

### The scale of action / notes on the estimate

As part of the implementation of the measure, the purchase of a new fleet of low-floor trams is recommended.

The purchase of new wagons, however, will not be tantamount to the withdrawal of the same number of high-floor wagons from the state of the Company, because the purchase of new trams is to increase the rolling stock potential.

However, some of them will replace the most worn-out high-floor cars.

After the completion of deliveries (along with the planned additional 90 trams) and the scrapping of the most worn-out carriages, the Company will still have approx. 350 high-floor trams - which corresponds to the demand for 175 low-floor trams (the indicated number of new trams is able to transport a proportionate number of passengers, every 350 high-floor trams).

The estimated expenses additionally represent the cost of preparation:

- pre-design work for the construction of a new metro line<sup>62</sup>,
- construction of a new tram route, based on the project to build a tram route to Wilanów<sup>64</sup>.

### Cost calculation

- Based on: Public procurement of the Warsaw Trams and the Warsaw Metro, Budget of the Capital City of Warsaw 2021.
- The proposed action is aimed at continuing the replacement of high-floor tram with low-floor ones. Estimated purchase costs of 175 new carriages of low-floor trams based on a tender for the purchase of 123 trams from Hyundai Rotem in Warsaw in 2021 for the amount of over 1.8 billion PLN (the price of one tram is 14.8 million PLN). Examples of the costs of implementing a new tram route are shown in the tender for the construction of tram route from the Warszawa Śródmieście station to Wilanów (7.5 km) worth 685,424 million PLN. This construction also includes the creation of 31 stops adapted to the needs of people with disabilities, the installation of electronic information boards with the timetable, which will be updated on a regular basis, the prioritization system for trams at intersections and the construction of three new traction substations.

## ID T1 Continued expansion of municipal integrated rail transport

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2032	Capital program	CT1, CT2, CT3, CT4, CT5

### Cost calculation cont.

The investments related to the preparation of the construction of a new metro station are illustrated by a tender for „Pre-design works on the construction of the third metro line in Warsaw – Stage I – Praga” worth 19.2 million PLN.

- Pre-investment costs determine the cost of developing technical documentation and a multi-discipline concept for the tramway line to Wilanów.
- On the other hand, the operating costs were estimated based on the actual budget expenses of the Capital City of Warsaw for the maintenance of public transport in 2021 (data refers to the company Tramwaje Warszawskie Sp. z o.o.). Assuming that the purchase of public transport services (the current fleet of 726 trams) costs PLN 906.2 million, the proportionate purchase of public transport services with a fleet of 175 new trams is estimated at approximately PLN 218 million.

### Financing mechanisms

- Recovery and Resilience Facility
  - E1.2.1. Zero and low emission public transport (streetcars), 200 million EUR in loans
- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.8: Promoting sustainable multimodal urban mobility as part of the transition towards a zero-emission economy
  - CODE 81. Clean urban transport infrastructure, 1260 million EUR grant
- Investment loans, green bonds
- Own funds of the City
- Cross-sectoral cooperation

### Body responsible for operation (in terms of track ownership)

- **Metro Warszawskie Sp. z o.o.**
- **Tramwaje Warszawskie Sp. z o.o. (track ownership)**

### Bodies supporting the implementation of action

- Public Transport Authority
- Infrastructure Department
- Architecture and Spatial Planning Department
- Economic Development Department

### Stakeholders

- Private and municipal enterprises
- Local society
- NGOs (non-government organizations)



## ID T1 Continued expansion of municipal integrated rail transport

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2032	Capital program	CT1, CT2, CT3, CT4, CT5
Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
Development of technical documentation for the tramway line to Wilanów	Pre-design work for the line III metro in Warsaw - Stage I - Praga	<ul style="list-style-type: none"> <li>• PLN 218 400 000</li> <li>• EUR 47 800 000</li> </ul>
<ul style="list-style-type: none"> <li>• PLN 6 241 400</li> <li>• EUR 1 366 700</li> </ul>	<ul style="list-style-type: none"> <li>• PLN 19 222 400</li> <li>• EUR 4 209 200</li> </ul>	
Development of a multi-discipline concept for a tramway line to Wilanów	Purchase of a low-emission tram fleet	
<ul style="list-style-type: none"> <li>• PLN 1 420 700</li> <li>• EUR 311 100</li> </ul>	<ul style="list-style-type: none"> <li>• PLN 2 596 500 000</li> <li>• EUR 568 570 000</li> </ul>	
	Construction of a new tram route	
	<ul style="list-style-type: none"> <li>• PLN 685 424 000</li> <li>• EUR 150 088 500</li> </ul>	
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
-	-	-
% of total CO <sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions		
-		

## ID T1 Continued expansion of municipal integrated rail transport

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2032	Capital program	CT1, CT2, CT3, CT4, CT5

Steps of implementation	Timeline									
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Purchase of a new tram fleet										
Conducting an analysis of the needs and implementation possibilities for the construction of a light rail network and stations in the densely populated suburbs of Warsaw										
Conducting the analysis of the needs and possibilities of the connection between Warszawa Wschodnia - Warszawa Gdańska										
Feasibility study for the construction of the III metro lines in Warsaw										
Design and construction of Stage I - Praga of Line III of the Warsaw Metro										
Development of technical documentation and a multi-discipline concept for new tram line sections										
Completion of tram connections to Tarchomin										
Completion of tram connections to Wilanów										

Product indicators	Result indicators
<ul style="list-style-type: none"> <li>• Construction of a new metro section</li> <li>• The length of a new tram route</li> <li>• Number of the new trams purchased</li> <li>• Purchase of a minimum of 400 new low-floor trams by 2030</li> <li>• Construction of a minimum of 18 km of new tramway route by 2030</li> </ul>	<ul style="list-style-type: none"> <li>• % increase of people traveling by public transport</li> <li>• % decrease in private cars moving around the city</li> <li>• A reduction in the average journey time by rail transport from the suburbs to the city centre, measured using the installed GPS system in public transport vehicles.</li> <li>• % reduction in air pollution emissions from the transport sector</li> </ul>

## ID T1 Continued expansion of municipal integrated rail transport

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2032	Capital program	CT1, CT2, CT3, CT4, CT5

### Action benefits

- Reduction in energy demand
- Renewable energy growth / reduction of fossil fuels
- Increased resilience to climate change
- Improved air quality
- Reduced share of private transport in road traffic
- Increased number of public transport users
- Increasing the role of public transport and low- and zero-emission mobility measures, including shared mobility and reducing the use of passenger cars
- Intensifying public transport and ecological forms of transport
- Public involvement

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- IT1 Integrated transport system management including integrated ticketing for the agglomeration
- T5 Research on public transport needs
- T3 Development of transport interchange and communication hubs

### Enabling policies and actions

- Strategy #Warsaw2030
- Sustainable mobility program
- Sustainable Urban Mobility Plan for the Warsaw Metropolis

## ID T1 Continued expansion of municipal integrated rail transport

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2032	Capital program	CT1, CT2, CT3, CT4, CT5

Smart potential	Gender and economic inclusion potential
<ul style="list-style-type: none"> <li>• Consolidation of latest digital technologies and business processes by railway companies</li> <li>• The use of innovative technologies related to the reduction of electricity consumption. Implementation of the "EcoDriving" system</li> <li>• Further development of ATMS (Advanced Traffic Management System) to give priority to trams at key intersections</li> <li>• Use of data-based analytics or agent-based modelling system (An agent model is a computational model for simulating the actions and interactions of autonomous agents in order to understand the behavior of the system and what governs its performance) to optimise the design of the investment and forecast future transport patterns and impact of investments</li> </ul>	<ul style="list-style-type: none"> <li>• These activities should implement the conclusions of the study "Analysis of public transport requirements and needs" with an emphasis on gender and a socially sensitive map of people's mobility</li> <li>• The implementation should take into account the security needs, especially of groups particularly vulnerable to violence: women, people representing ethnic, religious, cultural, sexual, and other minorities.</li> <li>• When planning the expansion and density of the connection network, the needs of people from economically disadvantaged groups, for whom public transport is the only travel option should be taken into account. The postulate of maintaining the maximum price availability of tickets or the system of subsidizing (or exempting from fees) for the poorest.</li> <li>• As part of new investments and modernization of areas, the principles of universal design should be applied.</li> </ul>

## ID T2 Convenient and safe zero-emission public transport

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CT1, CT3

### Description

Implementing new buses with electric or other zero-emission propulsion technology such as hydrogen in the entire city.

For many years, Warsaw has been carrying out activities aimed at replacing the bus fleet with low- and zero-emission ones. Gas and hybrid buses do not fulfil the conditions of complete zero-emissions, but the level of pollutants they emit is significantly lower than that of conventionally-powered buses.

However, the future perspective is to maintain a fully zero-emission fleet, therefore the City will want to focus on the implementation of a pilot program for regular use of hydrogen buses, which will further diversify the zero-emission fleet. This program will allow the testing and adaptation of appropriate infrastructure for the use of such vehicles on a wider scale. The replacement of the fleet will also improve comfort and safety for travelers. To support the development of the zero-emission fleet, the city will continue and expand the number of charging stations to be available at bus terminals, bus depots and long-stay bus locations. Powering these buses, where possible, should be via the city's photovoltaic installations. In addition, further delineation of new bus lanes, displaying information about the departure times of trains, trams and buses from the nearest stop in means of transport is planned to

improve the quality and efficiency of public transport.

### Background and justification

The city has been supporting activities related to the replacement of the fleet of public transport vehicles for years and has full control and influence on the purchase of buses. For this reason, it is an important opportunity to deepen and continue targeted activities that reduce local pollution and provide a visible sign of change for residents.

### The scale of action / notes on the estimate

The size of the entire MZA (Municipal Bus Operator company) fleet is 1,461 vehicles, of which 11% are already electric vehicles. This action is focused on switching the remaining fleet of vehicles with zero-emission vehicles. Warsaw will purchase buses with the lowest possible degree of pollutant emissions, taking into account the safety of service continuity. The amount of installing an electric vehicle charging point was estimated on the basis of a benchmark comparing the products of electric vehicle charging station manufactures, whose maximum power ranged from 72 kW to 248 kW.

The installation of electric vehicle charging points would take place on 48 bus loops located in Warsaw<sup>31</sup>.

Estimation of investment expenditures for installation of electric vehicle charging points does not include costs of distribution network extension and modernization of connections for specific stations. A perspective for the future is the choice of a fleet powered by hydrogen fuel. Although at this time there are no regular bus lines with hydrogen propulsion on Polish roads (except for research or test projects), there are proven technical solutions on the market that are used in neighboring countries. This action assumes the implementation of a pilot program using hydrogen-powered buses on the territory of the city of Warsaw.

## ID T2 Convenient and safe zero-emission public transport

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CT1, CT3

### Cost calculation

- Based on: Project for the purchase of 130 articulated electric buses Solaris - Miejskie Zakłady Autobusowe, Benchmark of market offers for electric vehicle charging points, Report "Critical Elements of Vehicle-to-Grid (V2G) Economics", Infrastructure Department, Cost-benefit analysis of the use of zero-emission buses in providing public transport services in the capital city of Warsaw, September 2021, The National Renewable Energy Laboratory (NREL), Energy Regulatory Office.
- The capital expenditure is the cost of purchasing 1,300 new (89% of all 1,461 buses)<sup>65</sup>, electric buses at the price set on the basis of the project to purchase 130 Solaris<sup>66</sup> electric buses by MZA (3.16 million PLN for 1 bus). The measure assumes the adaptation of 48 bus loops.

The estimated cost of building the charging infrastructure on one bus terminus (including station, switchgears, transformers, foundations, cabling) is approx. PLN 600 thousand. PLN (131.4 thousand. EUR). For adequate protection (e.g. in the event of a breakdown) and adaptation of electric vehicle charging points (multi-station loops), installation of more than one charger per a given bus loop should be assumed.

For 130 newly purchased electric buses, Miejskie Zakłady Autobusowe purchased 65 new chargers. Therefore it is assumed that the purchase of a proportionally 650 new vehicle charging stations. The estimated cost of delivery and assembly of one pantograph charging station (400 kW) is approx. 360 thousand PLN (79 thousand EUR). Capital expenditure also includes the estimated cost of implementing a pilot program to purchase 10 hydrogen-powered buses (the price of 1 bus was estimated based on NREL and is 4.9 million PLN).

- The operating costs were estimated only in terms of the cost of electricity consumption of the electric-powered bus in the amount of 176 PLN for each 100 km driven. The number of kilometers travelled by all buses in Warsaw in 2020 was over 85.6 million km. Within the framework of electric bus operation, it is necessary to take into account also the replacement of used batteries, which according to estimates may constitute the cost reaching even ¼ of the price of a new vehicle (in case of assumptions of this action the cost of replacement of batteries for all new buses may be even 1 billion PLN / 225 million EUR). Whereas the estimated costs of maintenance of electric vehicle charging points constitute 5% of the capital expenditures for installation of such points<sup>67</sup>.
- Estimated savings show the annual difference between the cost of diesel fuel used (PLN 350/100 km) to drive a conventional bus and the cost of energy used by an electric bus (PLN 176/100 km).

## ID T2 Convenient and safe zero-emission public transport

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CT1, CT3

### Financing mechanisms

- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.8: Supporting sustainable multimodal urban mobility as part of the transition to a zero-carbon economy
    - CODE 82. Clean urban transport fleet, 402 million EUR grants
- Own funds of public transport companies
- Loans, green bonds
- Own funds of the City

### Action owner

- **Infrastructure Department**

### Bodies supporting the implementation of action

- Public Transport Authority

### Stakeholders

- Private and municipal enterprises
- Local society
- NGOs (non-government organizations)

## ID T2 Convenient and safe zero-emission public transport

Timescale		Type of action	Short-term objectives of the GCCAP		
2023–2030		Capital program	CT1, CT3		
Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)	Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
-	Purchase of 1,300 new electric buses <ul style="list-style-type: none"> <li>• PLN 4 114 000 000</li> <li>• EUR 900 800 000</li> </ul> Costs of building the charging infrastructure on 48 loops <ul style="list-style-type: none"> <li>• PLN 28 800 000</li> <li>• EUR 6 300 000</li> </ul> The cost of supplying and installing 650 pantograph charging stations: <ul style="list-style-type: none"> <li>• PLN 234 000 000</li> <li>• EUR 51 200 000</li> </ul> Pilot program to purchase 10 hydrogen-powered buses: <ul style="list-style-type: none"> <li>• PLN 49 100 000</li> <li>• EUR 10 800 000</li> </ul>	The cost of using electricity to power an electric bus: <ul style="list-style-type: none"> <li>• PLN 150 800 000</li> <li>• EUR 33 000 000</li> </ul> Maintenance costs for electric vehicle charging points: <ul style="list-style-type: none"> <li>• PLN 11 700 000</li> <li>• EUR 2 600 000</li> </ul>	The difference per year between the purchase cost of the diesel used to power a conventional bus (299.8 mln PLN) and the purchase cost of the electricity for an electric bus (150,8 mln PLN): <ul style="list-style-type: none"> <li>• PLN 149 000 000</li> <li>• EUR 32 600 000</li> </ul>	115 400 tCO <sub>2</sub> /year 245 tNO <sub>2</sub> /year 3.66 tPM/year	0.96%
			<b>% of total CO<sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions</b>		
			9.61%		



## ID T2 Convenient and safe zero-emission public transport

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CT1, CT3

Steps of implementation	Timeline							
	2023	2024	2025	2026	2027	2028	2029	2030
Identification of vehicles that should be replaced with zero emission vehicles								
Cyclical purchase and expansion of the fleet of electric vehicles until the entire enterprise is zero-emission								
Installation of electric vehicle charging stations on 48 bus terminals								
Conducting a pilot program for the purchase and testing of hydrogen-powered buses								

Product indicators	Result indicators
<ul style="list-style-type: none"> <li>• Number of buses replaced with zero emission buses</li> <li>• Purchase of a minimum of 1300 new zero-emission buses by 2030</li> <li>• Installation of a minimum of 48 new electric vehicle charging points by 2030</li> </ul>	<ul style="list-style-type: none"> <li>• % reduction in air pollution emissions from the transport sector</li> <li>• % the share of zero-emission buses in the city</li> </ul>

## ID T2 Convenient and safe zero-emission public transport

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CT1, CT3

### Action benefits

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Renewable energy growth / reduction of fossil fuels</li> <li>• Increased resilience to climate change</li> <li>• Improved air quality</li> <li>• Reduced ambient noise</li> <li>• Improving the living conditions in the city</li> <li>• Increasing the role of public transport and low- and zero-emission mobility measures, including shared mobility and reducing the use of passenger cars</li> <li>• Intensifying public transport and ecological forms of transport</li> </ul> | <ul style="list-style-type: none"> <li>• Economic integration by providing access to convenient communication for all residents</li> <li>• Increased fuel efficiency</li> <li>• Lower maintenance costs</li> <li>• Less dependence on imported energy sources (EV buses only)</li> <li>• The new fleet of buses could offer greater comfort and passenger services such as USB charging and on-board Wi-Fi</li> <li>• On-board Wi-Fi can provide better origin and destination data for better route planning</li> </ul> |
|--|--|

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- T5 Research on public transport needs
- T6 Program supporting the implementation of Clean Transport Zones

### Enabling policies and actions

- "Green Public Transport" program
- Strategy #Warsaw2030
- Sustainable mobility program

## ID T2 Convenient and safe zero-emission public transport

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CT1, CT3
<b>Smart potential</b>		<b>Gender and economic inclusion potential</b>
<ul style="list-style-type: none"> <li>• Purchase of buses with amenities for passengers, which may include air conditioning (heating and cooling), Wi-Fi, audiovisual systems facilitating travel, LCD screens, passenger counting system for analyzing the needs and availability of vehicles, cameras improving passenger safety, USB sockets for charging passenger devices.</li> <li>• The management system and grid infrastructure varies from one part of the city to another, and it is possible that in some parts of the city it would need to be modernised and adapted to the new infrastructure for connecting electric vehicle charging points.</li> </ul>		<ul style="list-style-type: none"> <li>• Increasing the level of comfort and safety of participants traveling by public transport</li> <li>• Ensuring balanced participation of representatives of both genders in decision-making processes and the role of experts.</li> <li>• Ensuring equal access for women to green jobs - i.e., those related to the implementation of zero-emission rolling stock, as well as promoting the participation of women among city bus drivers and in training for this role.</li> <li>• The implementation should take into account the security needs, especially of groups particularly vulnerable to violence: women, people representing ethnic, cultural, religious, sexual, and other minorities; also people with reduced mobility (disabled, elderly people, with luggage, parents with children in prams).</li> <li>• As part of new purchases and investments, the principles of universal design should be applied.</li> </ul>

## ID T3 Development of transport interchange and communication hubs

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CT1, CT4, CT5

### Description

Construction and development of multimodal communication hubs (for 3-4 types of transport) integrating multi-mobility, micromobility, and sharing services.

Hubs would fulfil four purposes:

- a significant improvement in convenience and comfort for public transport passengers
- integration of different types of public transport
- creating communication hubs as local centers of social life
- restriction of car transport

Along with the multi-modal junction conversion program, the transformation of car parks into energy-independent islands will be implemented, along with greening and increasing permeable pavements to provide additional benefits in terms of adaptation and biodiversity.

Multimodal hubs will be selected in strategic locations (business centres, universities, existing stations, existing local centers of social life).

Depending on the location, the hubs will be the reconstruction of the existing stations, expansion or in justified cases, the construction of new ones.

These energy islands could comprise photovoltaic panels (car park roofs), energy storage, electric car charging stations or energy management systems. A pilot of such a program is being carried out at the Połczyńska Park&Ride car park, while analytical work is underway to implement the next stage - Park&Ride Młociny.

Multimodal hubs development is the opportunity to introduce apps and platforms (ex. Voom) which will allow the users to choose a wide range of travel possibilities and connections, to make traveling quick and comfortable.

The city will require sharing data by the providers of scooters, shared cars, bicycles. That data will allow the city to plan new investments in bicycle routes.

The activities carried out will take into account the provisions of the strategic document Sustainable Urban Mobility Plan for the Warsaw Metropolis.

### Background and justification

Warsaw is trying to support the development of a thriving multimodal transport system with more offer for passengers and the new idea of Mobility as a Service (MaaS). The transport hubs will help provide the infrastructure for faster adoption of new modes of transport to reduce the need to own and drive a car. Park & Ride offers an attractive combination of functions for piloting smart local low carbon energy systems: a large land area and a cohort of vehicles with long and predictable parking times. The rapid introduction of electric vehicles in the coming years will create the opportunity to transform Park and Ride into an energy balancing facility that supports the increase in the share of renewable energy sources in the Warsaw power grid.

The construction of a multimodal hubs could be implemented in cross-sectoral cooperation to deepen the development of relations with the private sector.

## ID T3 Development of transport interchange and communication hubs

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CT1, CT4, CT5

### Background and justification cont.

An example of building a multimodal hub on a small scale is a private investment (Mobility Hub by the Adgar Poland office building). The implemented solution could be applied in public spaces to develop some parking spaces and create places for shared vehicles and emission-free electric scooters, mopeds and bicycles with dedicated charging infrastructure.

### The scale of action / notes on the estimate

The presented pre-investment costs include the cost of a public contract for the implementation of a multi-variant concept of a new multimodal transport hub and the development of a technical study of the construction of an intermodal interchange. Capital expenditure determines the average cost of building a multimodal communication hubs.

### Cost calculation

- Based on: Benchmark of market offers for the construction of multimodal communication hubs in Poland, Public procurement for the capital city of Warsaw and the Public Transport Authority in Warsaw.
- The pre-investment costs of the multi-variant concept / analysis of the location of the new multimodal communication hub were estimated on the basis of the public procurement for the implementation of the multi-variant concept of the South Station interchange along with the functional, economic and legal analysis of the project, the cost of which amounted to over 612.5 thousand PLN<sup>68</sup>.
- Costs of developing a technical study for the construction of such a hub based on a tender (the amount allocated to finance the contract) for the development of a technical study for the construction of a multimodal Warsaw-East interchange, the cost of which was over 3.4 million PLN.

- Capital expenditure on the construction of a multimodal interchange was determined on the basis of the average price (after excluding the extreme values) from the benchmark of market offers for the construction of a multimodal transport hub in Poland (prices ranged from 38 million PLN to 600 million PLN).

## ID T3 Development of transport interchange and communication hubs

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CT1, CT4, CT5

### Financing mechanisms

- European Funds for Infrastructure, Climate, Environment Program 2021-2027

Objective 2.8: Supporting sustainable multimodal urban mobility as part of the transition to a zero-carbon economy

CODE 81. Clean urban transport infrastructure, 1260 million EUR grant

- Investment loans, green bonds
- Own funds of the City
- Cross-sectoral cooperation

### Action owner

- **Infrastructure Department**

### Bodies supporting the implementation of action

- Public Transport Authority
- Architecture and Spatial Planning Department
- European Funds and Development Policy Department
- Economic Development Department

### Stakeholders

- Private and municipal enterprises
- Local society
- NGOs (non-government organizations)

## ID T3 Development of transport interchange and communication hubs

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CT1, CT4, CT5
Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
Development of a multi-variant concept / location analysis for a new intermodal transport hub <ul style="list-style-type: none"> <li>• PLN 613 000</li> <li>• EUR 134 000</li> </ul> Development of a technical study for the construction of a multimodal interchange <ul style="list-style-type: none"> <li>• PLN 3 450 000</li> <li>• EUR 754 000</li> </ul>	Construction of a multimodal communication hubs <ul style="list-style-type: none"> <li>• PLN 184 000 000</li> <li>• EUR 40 300 000</li> </ul>	-
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
-	-	-
% of total CO <sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions		
-		

## ID T3 Development of transport interchange and communication hubs

Timescale	Type of action	Short-term objectives of the GCCAP							
2023–2030	Capital program	CT1, CT4, CT5							
<b>Steps of implementation</b>		<b>Timeline</b>							
		<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>	<b>2030</b>
Preparation of a tender for the development of a location analysis for the expansion and construction of communication nodes									
Development of a localization analysis document									
Preparation of a tender for the preparation of a feasibility study									
Development of a feasibility study document									
Obtaining financing									
Choosing a contractor									
Design and reconstruction of the intermodal transfer center indicated in the operation									
<b>Product indicators</b>		<b>Result indicators</b>							
<ul style="list-style-type: none"> <li>Construction of a multimodal communication hubs</li> </ul>		<ul style="list-style-type: none"> <li>% increase in the number of travelers using public transport</li> <li>% decrease in the number of private cars moving around the city</li> <li>% reduction in air pollution emissions from the transport sector</li> </ul>							



## ID T3 Development of transport interchange and communication hubs

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CT1, CT4, CT5
<b>Action benefits</b>		
<ul style="list-style-type: none"> <li>• Renewable energy growth / reduction of fossil fuels</li> <li>• Increased resilience to climate change</li> <li>• By moving people more efficiently, public transport is safer and causes much less air pollution than private cars.</li> <li>• Increasing the role of public transport and low- and zero-emission mobility measures, including shared mobility and reducing the use of passenger cars</li> <li>• creating favourable conditions for interchanging between different types of transport</li> <li>• Intensifying public transport and ecological forms of transport</li> <li>• Reduction in energy demand</li> <li>• Higher energy efficiency</li> <li>• Energy independence</li> <li>• Increased share of public transport in road traffic</li> <li>• Increased number of public transport users</li> <li>• Gender equality</li> <li>• Private sector involvement</li> <li>• Creation of new jobs</li> </ul>		
<b>Enabling actions within the Green City and Climate Action Plan of Warsaw</b>		<b>Enabling policies and actions</b>
<ul style="list-style-type: none"> <li>• T5 Research on public transport needs</li> <li>• IT1 Integrated transport system management including integrated ticketing for the agglomeration</li> </ul>		<ul style="list-style-type: none"> <li>• Strategy #Warsaw2030</li> <li>• Sustainable mobility program</li> <li>• New Study of the Conditions and Directions of Spatial Development for the Capital City of Warsaw</li> <li>• Sustainable Urban Mobility Plan for the Warsaw Metropolis</li> </ul>

## ID T3 Development of transport interchange and communication hubs

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CT1, CT4, CT5
<b>Smart potential</b>		<b>Gender and economic inclusion potential</b>
<ul style="list-style-type: none"> <li>• Implementation of a coherent management system and an integrated system for the operation of all types of transport connected by an integrated multimodal communication hub.</li> <li>• Implementation of an integrated information system.</li> </ul>		<ul style="list-style-type: none"> <li>• The strategy of building multimodal communication hubs should be based on the conclusions of the study "Analysis of public transport requirements and needs" and thematically related to the issue of transport exclusion.</li> <li>• Ensuring balanced participation of representatives of both genders in decision-making processes and expert roles and ensuring equal access of women to green jobs.</li> <li>• The creation of communication nodes as centers of social life should take into account the needs of accessibility and security, especially of groups particularly vulnerable to violence: women, people representing ethnic, cultural, religious, sexual, and other minorities.</li> <li>• As part of new investments and modernization of areas, the principles of universal design should be applied.</li> </ul>

## ID T4 Support for the development of electromobility

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Enabling action	CT1, CT3, CT4

### Description

Currently there is private car sharing in the city. Private systems mainly use hybrid cars and the small number of electric cars is due to the lack of widely distributed EV charging stations. The city should introduce a policy to encourage the use of low-emission vehicles (mainly hybrids that fulfil specific emissions criteria) and zero-emission vehicles (mainly electric) in this system and promote the development of low and zero-emission vehicles. The city should encourage taxi drivers and hire cars companies to introduce low and zero-emission cars to help speed decarbonisation. The implementation of the action should take place in the cross-sectoral cooperation model.

The city's role will be to oversee investment by implementing regulations and rules for the development of car sharing in the city, with incentives and concessions for private investors such as taxi companies.

The City Roads Authority has full knowledge of the structure of parking spaces used for car sharing and manages the parking infrastructure, which can identify the most suitable locations in the city for the installation of electric vehicle charging points.

The actions carried out will take into account the provisions of the strategic document Sustainable Urban Mobility Plan for the Warsaw Metropolis.

### Background and justification

Low- and zero-emission vehicles help reduce local air pollution and contribute to carbon reductions as the city's electricity supply decarbonises. The development of micromobility and transport sharing will have a leading role to achieve a climate-neutral city. Meanwhile, car sharing and travel sharing systems reduce the cost of travel and increases mobility choices for residents, including by responding to women's travel safety needs. Car sharing also helps to reduce the total number of cars on the road (whether parked or driving), which in turn can help free up space for active and public transport modes.

Therefore, the city should support the expansion of car sharing while also working to encourage adoption of low and zero emission fleets by car sharing scheme operators.

### The scale of action / notes on the estimate

Council of the Capital City of Warsaw has adopted the "Plan for the construction of publicly accessible charging stations for electric vehicles in the area of the Capital City of Warsaw", which provides for the installation of a total 816 charging points in 408 generally accessible stations in all districts.

As part of the action, it is proposed to install at least 816 new electric vehicle charging points in the area of the capital city of Warsaw. The cost estimate is based on a benchmark of 23 manufacturers of electric vehicle charging stations with a maximum power of 22 kW to 82 kW. The estimated capital expenditure does not include the costs of expanding the distribution network and modernizing connections for individual charging stations.

### Cost calculation

- Based on: Benchmark of 23 manufacturers of electric vehicle charging stations, Critical Elements of Vehicle-to-Grid (V2G) Economics Report, "Plan for the construction of publicly accessible charging stations for electric vehicles" – Public Transport Authority

## ID T4 Support for the development of electromobility

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Enabling action	CT1, CT3, CT4

### Cost calculation cont.

- The capital expenditure shows the cost of installing 816 electric vehicle charging points, at an average price (not including extreme values) set at 62,700 PLN for one charging point for electric vehicles.
- The operating costs of electric vehicle recharging points represent 5% of the capital expenditure for their installation<sup>69</sup>.

### Financing mechanisms

- Horizon Europe, loans
- LIFE Program (grants awarded by the European Commission, the contact point in Poland is National Fund for Environmental Protection and Water Management), grants
- Own funds of companies developing "car-sharing" systems
- Investment loans, green bonds
- Own funds of the City
- Cross-sectoral cooperation

### Action owner

- **Municipal Roads Authority**

### Bodies supporting the implementation of action

- Economic Development Department
- Architecture and Spatial Planning Department
- European Funds and Development Policy Department
- Public Transport Authority
- Traffic Management Department
- Infrastructure Department
- City Property and Treasury Department
- City districts

### Stakeholders

- Private and municipal companies
- Local society
- public administration
- NGOs (non-government organizations)

Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
-	PLN 51 200 000 EUR 11 200 000	PLN 2 600 000 EUR 560 000
<b>Estimated savings</b>	<b>Estimated CO<sub>2</sub> emission reduction</b>	<b>% reduction in GHG emissions compared to the 2018 inventory year</b>
-	-	-
<b>% of total CO<sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions</b>		
-		

## ID T4 Support for the development of electromobility

<b>Timescale</b>	<b>Type of action</b>	<b>Short-term objectives of the GCCAP</b>
2023–2029	Enabling action	CT1, CT3, CT4

Steps of implementation	Timeline						
	2023	2024	2025	2026	2027	2028	2029
Analysis of the location of new electric vehicle charging stations							
Creation of a car-sharing system development plan along with guidelines for car-sharing systems promoted in the city							
Establishing cooperation with the private sector							
Procurement of a contractor							
Designing and starting construction of new electric vehicle charging stations							

Product indicators	Result indicators
<ul style="list-style-type: none"> <li>• Number of new electric vehicle charging stations installed</li> <li>• Installation of a minimum of 816 new electric vehicle charging points by 2029</li> </ul>	<ul style="list-style-type: none"> <li>• % increase in the number of electric vehicles moving around the city</li> <li>• % decrease in the number of private cars moving around the city</li> <li>• % of reduction in air pollution emissions from the transport sector</li> </ul>

## ID T4 Support for the development of electromobility

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Enabling action	CT1, CT3, CT4

### Action benefits

- Renewable energy growth / reduction of fossil fuels
- Increased resilience to climate change
- Improved air quality
- Increasing the role of public transport and low- and zero-emission mobility measures, including shared mobility and reducing the use of passenger cars
- Economic integration by providing wide access to the car-sharing system
- Public involvement
- Private sector involvement
- Creation of new jobs

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- T3 Development of transport interchange and communication hubs
- IT2 Smart local energy systems incl. vehicle-to-grid and vehicle-to-building

### Enabling policies and actions

- The government program "My electric car" 2021
- Sustainable Urban Mobility Plan for the Warsaw Metropolis

## ID T4 Support for the development of electromobility

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Enabling action	CT1, CT3, CT4

Smart potential	Gender and economic inclusion potential
<ul style="list-style-type: none"> <li>The potential for the city, government and private companies to work together to develop an electric car incentive scheme and promote the development of electric car sharing.</li> </ul>	<ul style="list-style-type: none"> <li>Ensuring a balanced participation of representatives of both sexes in the creation of a city-wide internet platform and mobile application for car sharing. If this task becomes the subject of a tender / competition, one of the criteria for evaluating the proposal should be the involvement of women in the starting team.</li> <li>Providing equal access for women to green jobs - i.e., those related to the installation of charging stations for electric cars.</li> <li>All processes related to planning, implementation, and decision making should be well communicated with the residents. Measures to stimulate the involvement of residents in the process should also be used. The consultation process should involve organizations representing the interests of the local community as well as organizations related to ecological transport and activities for the sustainability of the planet.</li> </ul>

## ID T5 Research on public transport needs

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Enabling action	CT1, CT2, CT3, CT4, CT5

### Description

Deepening the analysis and research on transport needs in the city adapted to various social groups, gender, and people with disabilities. There is a need for regular and standardised research on transport demand and the quality of transport services in the city, in order to be able to monitor the state of services, observe whether they are improving and to be able to react when unfavourable changes are noticed. Currently, the city is conducting qualitative research on opinions on public services offered by the Capital City of Warsaw. The Office of Strategy and Analysis conducts research twice a year in the form of the Warsaw Barometer. Research on communication behaviour is carried out by Architecture & Spatial Planning Department as part of the Warsaw Traffic Research. There is a need to standardize and deepen the research carried out on the need for accessibility and the requirements of public transport (infrastructure, vehicles, routes, frequency, scope) including for people with disabilities, in terms of adapting stops and transfers to the needs of all users and the need to increase safety when traveling by public transport at night.

Surveys should pay special attention to access to jobs and other services for women, children, and the elderly. For a unified analysis, also transport companies that carry out their own research should be included. The surveys would be a potential source of information for the Public Transport Authorities to estimate user behaviour and what is the citizens willingness to change from proved owned cars to public transport. Surveys and analyses should be prepared with the use of smart technologies, such as agent-based modelling.

### Background and justification

A good understanding of user needs and areas for improvement allows for better planning and regulation, leading to better resource efficiency.

The analysis should consider the conclusions of the research conducted as part of the work on the Sustainable Urban Mobility Plan for the Warsaw metropolis.

### The scale of action / notes on the estimate

Conduct extended and detailed studies on the quality of transport services and analyses including an examination of the needs of residents in the public transport sector in the city.

### Cost calculation

- Based on: Public Transport Authority's procurement for the development of a document, whose scope was similar to that presented in the action<sup>70</sup>.
- Pre-investment costs are the cost of developing an analysis of the requirements and needs of public transport in the Capital City of Warsaw.

### Financing mechanisms

- Public procurement for the performance of a qualitative and quantitative study for the preparation and launch of a travel planning tool and movement around the Warsaw Functional Area by public transport as part of the project "Virtual Warsaw Functional Area (Virtual WOF)".
- Own funds of the City



## ID T5 Research on public transport needs

Timescale	Type of action	Short-term objectives of the GCCAP		
2023–2030	Enabling action	CT1, CT2, CT3, CT4, CT5		
<b>Action owner</b>				
<ul style="list-style-type: none"> <li>Architecture and Spatial Planning Department</li> </ul>				
<b>Bodies supporting the implementation of action</b>				
<ul style="list-style-type: none"> <li>Infrastructure Department</li> <li>Public Transport Authority</li> <li>Strategy and Analysis Department</li> </ul>				
<b>Stakeholders</b>				
<ul style="list-style-type: none"> <li>Transport companies</li> <li>Private and municipal enterprises</li> <li>Local society</li> <li>NGOs (non-government organizations)</li> </ul>				
<b>Pre-investment (PLN, EUR)</b>		<b>CAPEX (PLN, EUR)</b>		<b>OPEX (PLN, EUR)</b>
PLN 350 000		-		-
EUR 76 600				
<b>Estimated savings</b>		<b>Estimated CO<sub>2</sub> emission reduction</b>		<b>% reduction in GHG emissions compared to the 2018 inventory year</b>
-		-		-
<b>% of total CO<sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions</b>				
-				

## ID T5 Research on public transport needs

Timescale	Type of action	Short-term objectives of the GCCAP						
2023–2030	Enabling action	CT1, CT2, CT3, CT4, CT5						
<b>Steps of implementation</b>	<b>Timeline</b>							
	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>	<b>2030</b>
Preparation of a tender for the analysis, preparation of a system of regular researching transport needs in the city								
Development of analysis and research of transport needs								
Cyclical carrying out of previously developed analyses and tests								
<b>Product indicators</b>		<b>Result indicators</b>						
<ul style="list-style-type: none"> <li>Number of developed and implemented analyses and research of transport needs and requirements in the city</li> </ul>		<ul style="list-style-type: none"> <li>An increase in the accessibility of public transport services to travellers, expressed in terms of an increase in the number of kilometres of new network links and the number of public transport vehicles purchased</li> </ul>						

## ID T5 Research on public transport needs

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Enabling action	CT1, CT2, CT3, CT4, CT5
<b>Action benefits</b>		
<ul style="list-style-type: none"> <li>Increasing the role of public transport and low- and zero-emission mobility measures, including shared mobility and reducing the use of passenger cars</li> <li>Intensifying public transport and ecological forms of transport</li> <li>Increased share of public transport in road traffic</li> </ul>		<ul style="list-style-type: none"> <li>Economic integration by providing all residents with access to convenient communication</li> <li>Gender equality</li> <li>Public involvement</li> </ul>
<b>Enabling actions within the Green City and Climate Action Plan of Warsaw</b>		<b>Enabling policies and actions</b>
<ul style="list-style-type: none"> <li>T1 Continued expansion of municipal integrated rail transport</li> <li>T2 Convenient and safe zero-emission public transport</li> <li>T6 Program supporting the implementation of Clean Transport Zones</li> </ul>		<ul style="list-style-type: none"> <li>Sustainable Urban Mobility Plan for the Warsaw Metropolis</li> <li>Strategy #Warsaw2030</li> <li>Sustainable mobility program- executive program of the Strategy #Warszawa2030</li> </ul>
<b>Smart potential</b>		<b>Gender and economic inclusion potential</b>
<ul style="list-style-type: none"> <li>Surveys, analyses, data sharing and monitoring interfaces with the use of smart technologies, such as agent-based modelling.</li> </ul>		<ul style="list-style-type: none"> <li>The analysis should take into account mobility maps, transport needs and the safety needs of women and across different socio-economic groups (including economically disadvantaged groups), groups at risk of violence in public space: in addition to women - ethnic, cultural, religious and sexual and other, groups defined according to the caring relationship (parents and carers of the elderly or the sick / disabled), people with disabilities - physically and mentally, and the elderly.</li> </ul>

## ID T6 Program supporting the implementation of Clean Transport Zones

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2026	Capital program	CT1, CT2, CT3, CT4

### Description

Implementing a support program for conducting in-depth feasibility studies of Clean Transport Zones, indicating the need for the location of additional Park and Ride car parks. The implementation of Clean Transport Zones should not lead to transport exclusion of inhabitants, who do not have access to low and zero emission vehicles. The launch of the zones must be accompanied by an improvement in the offer of public transport and an intensification of actions to improve pedestrian and cycle infrastructure.

Based on the conducted expert opinions, the areas of pilot programs should be selected, preceding the selection of areas for the implementation of the zone functioning. The implementation of the program should focus on the areas where walking, cycling and other means of transport (e.g., scooters) are abundant. The Program will support ongoing municipal initiatives related to the introduction of such zones.

The program will include carrying out impact analyses and proposing support for neighbouring municipalities, relieving the units and people who will be affected by the implementation of the zones.

The city's ITS infrastructure (*Intelligent Transportation*) will also be actively used from the start to support the program. Systems such as informing the drivers, renewing the Mobile App the prevention of entry into designated areas of vehicles exceeding reference CO<sub>2</sub> emission levels through a number plate recognition system and the development of clean modes of transport will ensure the success of the programme both in the Zones and in the rest of the city.

### Background and justification

Air pollution is a key problem in Warsaw and the city is obliged to introduce limited transport zones in a pilot version until 2023 and in a target version until 2026 based on the requirements of the Air Protection Program adopted for the Mazowieckie Voivodeship.<sup>71</sup> Reducing the number of vehicles in some areas of the city and encouraging the vehicles owners to adapt to the criteria, like vehicles that meets a higher emission standard, will help to reduce both traffic and pollution in the short term and create an incentive for the development of a low emission vehicle market in the long term.

### The scale of action / notes on the estimate

The costs were estimated based on public procurements for the Development of City Electromobility Development Strategy, the scope of which was similar to that assumed in the action.

### Cost calculation

- Based on the benchmark of market offers, many years of experience and extensive knowledge in the implementation of similar projects by Arup.
- The amount of pre-investment costs is the cost of developing a support program for in-depth feasibility studies for the Clean Transport Zone - as part of the program, location analyses for the Zones, additional P&R needs in connection with the implementation of the zones, and an analysis of the impact of the implementation of the zones on the neighbouring municipalities, units servicing zones and people communicating with and to the zones.

## ID T6 Program supporting the implementation of Clean Transport Zones

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2026	Capital program	CT1, CT2, CT3, CT4

### Financing mechanisms

- Own funds of the City

### Action owner

- Road Traffic Management Department

### Bodies supporting the implementation of action

- Architecture and Spatial Planning Department

### Stakeholders

- European Funds and Development Policy Department
- Offices of the City of Warsaw
- Private enterprises
- Local society
- NGOs (non-government organizations)

Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
PLN 350 000	-	-
EUR 76 600		
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
-	-	-
% of total CO <sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions		
-		

## ID T6 Program supporting the implementation of Clean Transport Zones

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2026	Capital program	CT1, CT2, CT3, CT4

Steps of implementation	Timeline			
	2023	2024	2025	2026
Promotion and fundraising for the actions				
Conducting a tender and selecting a contractor to develop in-depth feasibility studies for low-emission zones with an indication of the need for the location of additional Park and Ride car parks				
Development of in-depth feasibility studies for low-emission zones with an indication of the need for the location of additional P&R car parks and the forecast of the impact on the neighboring areas and neighboring communes				

Product indicators	Result indicators
<ul style="list-style-type: none"> <li>Implementation of a program supporting Clean Transport Zones by 2023</li> <li>Preparation of pre-design documentation</li> </ul>	<ul style="list-style-type: none"> <li>Number of selected P&amp;R locations and clean Transport Zones</li> <li>Number of completed transfer hubs</li> </ul>

## ID T6 Program supporting the implementation of Clean Transport Zones

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2026	Capital program	CT1, CT2, CT3, CT4

### Action benefits

- Reduction in energy demand
- increasing the role of public transport and reducing individual transport
- Intensifying public / ecological forms of transport
- Increasing and / or protection of green areas
- Increased resilience to climate change
- Reduction of greenhouse gas emissions
- Reduction of air pollution and improving of air quality
- Noise reduction
- Reducing traffic jams on the roads
- Road noise reduction
- Creating traffic calmed areas that can be local centers of social life
- Economic integration
- Improving the quality of life by reducing exhaust emissions and improving air quality
- Revenues from entering the clean transport zone can be used for other goals of the sustainable development of the city

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- T4 Support for the development of electromobility
- T5 Research on public transport needs

### Enabling policies and actions

- STOP SMOG - Clean Air Program
- Strategy #Warsaw 2030
- Environmental protection program for the Capital City of Warsaw for the years 2021-2024
- Updating the National Air Protection Program until 2025 (with an outlook until 2030 and 2040)
- Act on electromobility – Act of January 11, 2018 on electromobility and alternative fuels
- Sustainable Mobility Program

## ID T6 Program supporting the implementation of Clean Transport Zones

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2026	Capital program	CT1, CT2, CT3, CT4
<b>Smart potential</b>		<b>Gender and economic inclusion potential</b>
<ul style="list-style-type: none"> <li>The air quality data from the Warsaw Air Quality Monitoring System will be used for the Study of the Conditions and Directions of Spatial Development for the Capital City of Warsaw preparation, as well as for monitoring of the Clean Transport Zones implementation</li> <li>The feasibility study will assess the potential to implement electronic monitoring of access restrictions of categories of vehicles to Clean Transport Zones. Data collected will be input data to the ITS.</li> </ul>		<ul style="list-style-type: none"> <li>Including the needs of all transport users as part of the program implementation, with particular emphasis on the needs of less mobile, non-motorized groups, particularly exposed to the effects of air pollution concentration in the city, such as the elderly, women, children, and the poor.</li> <li>Including residents who cannot afford purchase of green vehicles.</li> <li>Ensuring accessibility and a way of moving around the city that is convenient for all residents and ensuring that the location of low-emission zones takes into account the inclusiveness postulates. Providing a convenient location of P&amp;R car parks and access to convenient and fast public transport or other alternative transport options for private cars.</li> <li>As part of investment activities, the needs of people with reduced mobility should be taken into account and the principles of universal design should be applied.</li> <li>Ensuring appropriate conditions so that all processes related to planning, implementation and decision making are well communicated with residents. Use of measures to stimulate the involvement of residents in the process. Including in the consultation process organizations representing the interests of the local community, as well as organizations related to the protection of air purity and activities for the health and sustainability of the planet.</li> </ul>



## ID IT1 Integrated ticketing for the agglomeration as a part of public transport management

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2027	Capital program	CT1, CT2, CT3, CT4, CT5

### Description

For years, the City of Warsaw has been implementing initiatives to develop transport services in the city and neighbouring municipalities. Providing services by diverse modes of transport (rail, metro, tram, bus, public bicycle) is achieved through a coherent tariff offer for the inhabitant/passenger, adaptation of timetables of Warsaw Public Transport vehicles allowing for convenient transfers from one mode of transport to another, as well as entering into agreements with neighbouring municipalities for providing services for their residents using Warsaw Public Transport vehicles. Passengers having selected tickets from the current tariff of the Capital City of Warsaw on the basis of concluded agreements can use trains operated by external carriers, i.e., the Mazovia Railways (KM) and Warsaw Commuter Rail (WKD), within designated ticket zones (the so-called ZTM-KM-WKD Common Ticket). The new project aims to increase the attractiveness of public transport through the expansion and unification of the tariff offer and ticketing system. In addition, it is planned to provide users of the Warszawski Transport Publiczny (buses, trams, metros, public bicycles, trains) with a dynamic journey planner to find the most convenient connection, which will contribute to popularising the use of public transport.

The integrated, contocentric system, based on the City User of Warsaw's Platform for Urban Services (PeUM/mojaWarszawa), will help to extend the offer of a single transport ticket for various modes of transport. Particularly important features of the new solution from the point of view of the resident/passenger are the transparency of the rules in force, convenience of use or time savings resulting from the availability of the new solution, e.g., in a mobile application. The system should enable the inclusion of offers from external carriers such as WKD and KM. One element of the system's functionality that should be included is the ability to purchase tickets for transport services via a city app, offering different types of tickets, including a long-distance ticket. The system as a development will enable integrated functionality to provide customers with access to flexible and easy multimodal travel. The system as a service must become part of the Urban Services Platform and use other services, not just public transport. These will include services under an entitlement linked to the urban system, such as the Warsaw Citizen Card, but also services provided by commercial operators.

### Background and justification

Good coordination and management will facilitate the further integration of the multi-modal ticketing system for the Warsaw agglomeration. It will also

enable the integration of e-tickets and electronic vehicle location tracking and transport management within a single application under the supervision of the City.

All this will improve the user experience and increase the popularity of public transport services. The city, as the operator of the application, will be able to obtain anonymous information on the ways of travel of residents, i.e., on times, locations and selected means of communication. Such an application will enable the creation of databases on traffic flows and will allow the use of this data for later planning stages. The application, which will provide users with messages about possible difficulties and delays on planned journeys, will be integrated with a journey planner. In addition, by collecting a wide variety of data about the use of transport services, the city will gain the ability to analyse and make decisions about adapting the transport services provided to real needs and respond flexibly to changes in user preferences. All of this will improve user comfort and increase the popularity of public transport services. The city, as the application's operator, will obtain anonymous information on residents' travel patterns, i.e., times, locations and means of transport chosen. This will enable the creation of traffic flow databases for use in later planning stages.

## ID IT1 Integrated ticketing for the agglomeration as a part of public transport management

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2027	Capital program	CT1, CT2, CT3, CT4, CT5

### The scale of action / notes on the estimate

The estimate should include the individual components of the ticketing system, which will include:

- Central system as a service in PeUM,
- Integration and connection to city microservices,
- API and microservice for a mobile application (e.g., mobiWAWA),
- API and end-service in PeUM,
- Passenger portal,
- OT devices (ticket punchers, controller readers, etc.),
- Operation and maintenance issues of the system.

### Cost calculation

- Based on: mapadotacji.gov.pl,
- The costs were estimated on the basis of the project to increase the accessibility of regional rail transport in the Pomorskie Voivodeship through its integration with local transport - the construction of an electronic platform for integrated mobility services. The calculation was made in 2020, it will be necessary to make an update immediately prior to project implementation.

The subject of this project was the construction and implementation of the electronic Platform for Integrated Mobility Services (PZUM), which allowed for the optimal planning and payment of travel by rail and local transport in the area, where agglomeration or provincial passenger rail transport is carried out. It is a solution that allows to collect all the principles of the functioning of public transport in the voivodeship on one internet platform. None of the carriers lose their autonomy, but thanks to electronic integration they all function as one structure. The essence of the integrated e-mobility platform is the fact that passengers will receive an advanced tool allowing for a simple and intuitive use of public transport, including multimodal travel.

### Financing mechanisms

- Recovery and Resilience Facility
  - B3.4.1. Investments for the comprehensive green transformation of cities, 2800 million EUR in loans
- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.8 Supporting sustainable multimodal urban mobility as part of the transition to a zero-carbon economy
  - CODE 84. Digitalization of urban transport, 87 million EUR grant

- Investment loans, green bonds

- Own funds of the City

### Action owner

- **Public Transport Authority**

### Bodies supporting the implementation of action

- Infrastructure Department
- IT Department

### Stakeholders

- Warsaw Public Transport communication operators (MZA, TW, MW, SKM),
- external ticketing operators, other operators (e.g., KM, WKD),
- municipal authorities within the framework of concluded agreements,
- Local society
- NGOs (non-government organizations)

## ID IT1 Integrated ticketing for the agglomeration as a part of public transport management

Timescale	Type of action	Short-term objectives of the GCCAP			
2023–2027	Capital program	CT1, CT2, CT3, CT4, CT5			
<b>Pre-investment (PLN, EUR)</b>	<b>CAPEX (PLN, EUR)</b>	<b>OPEX (PLN, EUR)</b>			
-	PLN 130 000 000	-			
	EUR 28 550 000				
<b>Estimated savings</b>	<b>Estimated CO<sub>2</sub> emission reduction</b>	<b>% reduction in GHG emissions compared to the 2018 inventory year</b>			
-	-	-			
<b>% of total CO<sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions</b>					
-					
<b>Steps of implementation</b>	<b>Timeline</b>				
	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
Development of guidelines for an integrated ticketing system including preparation of tender documents and estimation of the contract value					
Implementation of a ticketing system					
Monitoring of the ongoing work and implementation of the integrated ticketing system					
<b>Product indicators</b>	<b>Result indicators</b>				
<ul style="list-style-type: none"> <li>Implementation of long-term tickets in the mobile application system</li> <li>Construction and implementation of an electronic Platform of Integrated Mobility Services (common application) by 2027</li> </ul>	<ul style="list-style-type: none"> <li>% increase of people traveling by public transport</li> <li>% decrease in private cars moving around the city</li> </ul>				

## ID IT1 Integrated ticketing for the agglomeration as a part of public transport management

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2027	Capital program	CT1, CT2, CT3, CT4, CT5

### Action benefits

- Reduction in energy demand
- Renewable energy growth / reduction of fossil fuels
- Increased resilience to climate change
- Improved air quality
- Increasing the role of public transport and low- and zero-emission mobility measures, including shared mobility and reducing the use of passenger cars
- Intensifying public transport and ecological forms of transport
- Increased use of public and active mobility
- Ticket purchase and usage data provides a rich set of starting point and destination data for planning future routes and services
- Reduced traffic jams (prioritization of public transport in traffic light programs).

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- T5 Research on public transport needs
- T3 Development of transport interchange and communication hubs

### Enabling policies and actions

- Sustainable Urban Mobility Plan for the Warsaw Metropolis
- Strategy #Warsaw2030
- Sustainable mobility program

### Smart potential

- Data collection and share for the city Intelligent planner application use
- Integration of all means of transport into the transport management system

### Gender and economic inclusion potential

- Ensuring balanced participation of representatives of both sexes in decision-making processes and in expert roles in creating instruments and tools for central management of all forms of transport, creating a single ticket for multi-modal forms of transport and a long-term ticketing system.
- All processes related to planning, implementation, and decision making should be well communicated with the residents. The consultation process should involve organizations representing the interests of the local community as well as organizations related to ecological transport and activities for the sustainability of the planet.

## ID IT2 Smart local energy systems including vehicle-to-grid and vehicle-to-building

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2025	Capital program	CT3, CE1, CE2, CE4, CB2, CB3

### Description

Development of a feasibility analysis of smart grid system and implementation strategy for Vehicle to Grid (V2G) systems. The action includes both V2G systems and also V2B (Vehicle-to-Building) applications, including basic bidirectional charging solutions. The development of strategy for vehicle to grid and vehicle to building systems will support other GCCAP actions, such as: implementation of an integrated transport policy, car sharing - electromobility development policy or purchase of green energy for municipality units. The use of green energy, along with the implementation of smart local energy systems (e.g., vehicle to grid) will increase the infiltration of renewable energy into the electricity grids.

The study will additional analysis to which extent the existing energy grid should have to be upgraded.

### Background and justification

Smart Local Power Systems enable increased penetration of renewable energy as a source of energy supplied through mains electricity.

They make it possible to ensure the stabilization and continuity of the supply of energy from renewable sources. In the event of a failure, solutions constituting energy storage and off-grid installations allow to maintain energy security.

### The scale of action / notes on the estimate

Cost estimation based on the benchmark of market offers and many years of experience and extensive internal knowledge in the implementation of similar projects by the Consultant.

### Cost calculation

- Based on: Arup Benchmarks,
- The pre-investment costs include the costs of preparing a feasibility study (500,000 PLN) and the development strategy for V2G systems (350,000 PLN).

### Financing mechanisms

- Recovery and Resilience Facility
  - B3.4.1. Investments for the comprehensive green transformation of cities, 2800 million EUR in loans
- European Funds for Infrastructure, Climate, Environment Program 2021-2027

- Objective 2.2. Promoting renewable energy
  - CODE 53. intelligent energy systems and related storage, 7.1 million EUR of grants from the European Regional Development Fund for more developed regions
- Own funds of energy enterprises operating in the City
- Own funds of companies developing charging infrastructure for electric vehicles
- Investment loans, green bonds

### Action owner

- **Infrastructure Department**

### Stakeholders

- Private and municipal enterprises
- Local society
- NGOs (non-government organizations)

## ID IT2 Smart local energy systems including vehicle-to-grid and vehicle-to-building

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2025	Capital program	CT3, CE1, CE2, CE4, CB2, CB3
Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
PLN 850 000	-	-
EUR 186 000	-	-
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
-	-	-
% of total CO <sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions		
-		

## ID IT2 Smart local energy systems including vehicle-to-grid and vehicle-to-building

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2025	Capital program	CT3, CE1, CE2, CE4, CB2, CB3

Steps of implementation	Timeline		
	2023	2024	2025
Preparation of a tender for feasibility analysis and implementation strategy for <i>vehicle-to-grid</i> and <i>vehicle-to-building</i> systems			
Development of a feasibility analysis and implementation strategy for <i>vehicle-to-grid</i> and <i>vehicle-to-building</i> systems			

Product indicators	Result indicators
<ul style="list-style-type: none"> <li>Development of implementation strategy for <i>vehicle-to-grid</i> systems by 2025</li> </ul>	<ul style="list-style-type: none"> <li>Number of V2G and V2B systems feasibility studies performed</li> <li>An increase in the number of car sharing vehicle rentals in the city</li> </ul>

## ID IT2 Smart local energy systems including vehicle-to-grid and vehicle-to-building

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2025	Capital program	CT3, CE1, CE2, CE4, CB2, CB3
<b>Action benefits</b>		
<ul style="list-style-type: none"> <li>• Reduction in energy demand</li> <li>• Renewable energy growth / reduction of fossil fuels</li> <li>• Increasing the role of public transport and low- and zero-emission mobility measures, including shared mobility and reducing the use of passenger cars</li> <li>• Increased resilience to climate change</li> <li>• Improved air quality</li> <li>• Reduced share of private vehicles in road traffic</li> <li>• Possibility to accumulate PV energy</li> <li>• Economic integration by educing energy costs</li> <li>• Public involvement</li> </ul>		
<b>Enabling actions within the Green City and Climate Action Plan of Warsaw</b>		<b>Enabling policies and actions</b>
<ul style="list-style-type: none"> <li>• T4 Support for the development of electromobility</li> </ul>		<ul style="list-style-type: none"> <li>• The government program "My electric car" 2021</li> </ul>
<b>Smart potential</b>		<b>Gender and economic inclusion potential</b>
<ul style="list-style-type: none"> <li>• The action is fully „smart oriented“</li> <li>• Development of innovative solutions for intelligent local energy systems</li> </ul>		<ul style="list-style-type: none"> <li>• Ensuring balanced participation of representatives of both genders in the processes when creating the feasibility analysis and implementation strategy for Vehicle to Grid systems.</li> <li>• Ensuring equal access for women to green jobs - i.e., jobs related to the implementation of V2G solutions.</li> </ul>



# Solid waste



## ID Ok1 Municipal biogas plants development program

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CO1, CO2, CO3

### Description

The initiative aims to develop biogas production from biodegradable waste in Warsaw. The city is currently planning to build its first biogas plant, which will process around 100,000 tonnes of waste per year. The primary source of waste (up to 85% of the input) will be kitchen waste from the brown bin, with the remaining fraction consisting of waste from green spaces. The biogas produced will serve a dual purpose: it will generate heat and electricity using cogeneration equipment with a capacity of approximately 1 MW, and it will be processed into compressed natural gas (CNG) for use as fuel in vehicles operated by the Municipal Cleaning Company of Warsaw (MPO) and city buses.

The city will monitor the market situation for biodegradable waste, and if there is a need for additional facilities for its management, the city may develop more generation units that use biodegradable waste from sources like green spaces. However, this action does not involve the production of biogas from sewage treatment plant sludge, which is part of the E3 Aspirations of the Municipal Water and Sewerage Company of the Capital City of Warsaw to become climate neutral

### Background and justification

Utilizing biodegradable waste to generate renewable heat and electricity and producing renewable fuel for city vehicles in the form of compressed natural gas (CNG) derived from biogas, will play a crucial role in helping Warsaw achieve climate neutrality. The development of urban biogas is an excellent example of implementing circular economy principles, where waste is treated as a valuable resource rather than discarded as trash.

Rather than simply storing and disposing of waste, it can be repurposed to generate clean energy and heat, while the by-products produced during biogas production can serve as environmentally-friendly fertilizers. With the construction of the biogas plant and the use of green energy and fuels derived from biogas for its operations, the Municipal Cleaning Company (MPO) can lower its operating costs, which will positively impact the company's financial balance sheet.

### Cost calculation

- The cost calculation was based on MPO's estimates, while the calculation of CO2 emission reductions and projected cost savings was based on Arup indicators.
- The expected cost savings represent the difference between the reduction in operating costs resulting from MPO's use of energy and fuels derived from biogas for its own consumption, as well as the potential to sell fuel (CNG), compost, and fertilizer, and the operating costs associated with the biogas plant.

## ID Ok1 Municipal biogas plants development program

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CO1, CO2, CO3

### Financing mechanisms

- MPO's own resources,
- own funds of the city,
- Recovery and Resilience Facility,
- European Fund for Infrastructure, Climate, Environment Program 2021-2027,
- investment loans, green bonds,
- credits, loans from European financing institutions (e.g. European Investment Bank, European Bank for Reconstruction and Development).

### Action owner

- **Municipal Cleaning Company**

### Bodies supporting the implementation of action

- Infrastructure Department

### Stakeholders

- Air Protection and Climate Policy Department
- Local society
- NGOs related to the ecological cycle of waste and activities to sustain the planet

## ID Ok1 Municipal biogas plants development program

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CO1, CO2, CO3
<b>Pre-investment (PLN, EUR)</b>	<b>CAPEX (PLN, EUR)</b>	<b>OPEX (PLN, EUR)</b>
PLN 125,000	PLN 220,000,000	PLN 25,000,000
EUR 27,400	EUR 48,173,800	EUR 5,474,000
including the development of a technical and technological concept for the biogas plant, the preparation of a report on the environmental impact of the investment and the cost of obtaining an environmental decision for the investment	Costs included: <ul style="list-style-type: none"> <li>• Development of the Functional and Utility Programme (PLN 200,000 / EUR 43,800)</li> <li>• Biogas plant project (PLN 950,000 / EUR 208,000)</li> <li>• Construction of the biogas plant together with commissioning (PLN 215,600,000 / EUR 47,210,000)</li> <li>• Supervision of the biogas plant implementation by the Contract Engineer (PLN 3,250,000 / EUR 712,000)</li> </ul>	
<b>Estimated savings</b>	<b>Estimated CO<sub>2</sub> emission reduction</b>	<b>% reduction in GHG emissions compared to the 2018 inventory year</b>
PLN 3,733,000	5,600 tCO <sub>2</sub> /year*	0.05% in chemical energy in fuel producing electricity compared to burning coal
EUR 817,000	Does not take into account emission reductions from vehicles powered by manufactured CNG	
<b>% of total CO<sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions</b>		
0.47%		

## ID Ok1 Municipal biogas plants development program

Timescale	Type of action		Short-term objectives of the GCCAP				
2023–2029	Capital program		CO1, CO2, CO3				
<b>Steps of implementation</b>	<b>Timeline</b>						
	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>
Obtaining a valid Environmental Decision for the project							
Selection of contractor for the Functional and Utility Programme							
Functional and Utility Programme							
Selection of contractor for the biogas plant (implementation in the form of "design and build")							
Obtaining planning permission (+ environmental reassessment)							
Construction							
Selection of the Contract Engineer							
Supervision of the implementation of the investment by the Contract Engineer							
Compost certification							
<b>Product indicators</b>				<b>Result indicators</b>			
<ul style="list-style-type: none"> <li>• Construction of biogas plant by 2029,</li> <li>• Management of 80 000 – 100 000 Mg of biodegradable waste per year</li> </ul>				<ul style="list-style-type: none"> <li>• Increase in the stream of managed biodegradable waste in and around Warsaw, expressed in Mg/year</li> <li>• % of production of electricity and heat from renewable sources</li> <li>• % decrease in the share of energy from conventional sources</li> </ul>			

## ID Ok1 Municipal biogas plants development program

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2029	Capital program	CO1, CO2, CO3

### Action benefits

- Reducing the waste stream going to landfills, which creates benefits in terms of less landfill gas production
- Renewable energy growth and reduction of fossil fuels
- Improving local waste management
- Change of energy source
- Zero-emission fuel for MPO vehicles and city buses
- Low-emission energy plant, environmentally friendly biogas
- Reduction of the amount of soil and water contamination by managing troublesome waste biomass
- Public involvement
- Creation of new jobs
- Gender equality
- Establishment of an outlet for biogas substrates
- Increase in innovation and competitiveness of implemented projects
- Reduction of the number and area of landfills
- Increase the level of recycling

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- E2 Generation of green Energy by the city within and outside Warsaw's borders
- E6 Energy strategic partnership

### Enabling policies and actions

- Poland's energy policy until 2040

### Smart potential

- Implementation of various optimization functions and technologically advanced components - coordination and monitoring of processes, making decisions on the use of biogas.

### Gender and economic inclusion potential

- As part of new investments and modernization of areas, the principles of universal design should be applied
- Ensuring a balanced participation of representatives of both genders in the structures of a newly built biogas plant - especially in the area of decision-making, management and technical employees.

## ID Ok2 HWRC- Household waste recycling centres

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CO1, CO2, CO3, CO4

### Description

The proposed action concerns the creation of separate household waste recycling centres (HWRCs), which ensure the collection of waste paper, metals, plastics, glass, multi-material packaging waste, hazardous waste, expired medicines and chemicals, used batteries and accumulators, waste electrical and electronic equipment, furniture and other bulky waste, used tires and waste textiles and clothing, as well as waste construction and demolition of households. The development of the location of household waste recycling centres (HWRCs) would be subject to a detailed location assessment. It is important that the created separate collection points for municipal waste are user-friendly and offer high-quality service and high availability (e.g., through different opening hours).

Currently functioning HWRCs are run by external companies commissioned by the City. HWRCs are supported by properly adapted and marked cars, the so-called mobile selective municipal waste collection points (MHWRCs). MHWRCs operate in the itinerary system, stopping twice a week in 40 designated places throughout the city, at specific times, according to the agreed schedule.

There is a need to create additional HWRCs in the city.

### Background and justification

HWRCs allows residents to donate municipal waste that is not collected directly from the property, especially hazardous waste. An effectively functioning HWRCs is an integral element of the municipal waste management system in the city. It enables safe and controlled disposal of waste, its proper management, as well as the achievement of the levels of municipal waste recycling required by law. Such activities are part of the implementation of the idea of sustainable development and increasing the standard of living of the inhabitants, they ensure the protection of the natural environment by minimizing the phenomenon of illegal abandonment of waste and creating the so-called "Wild dumps".

### The scale of action / notes on the estimate

The action assumes construction of Household waste recycling centres (HWRC) in 9 separate waste collection zones in Warsaw. Currently there are 2 HWRCs operating in Warsaw.

The estimated capital expenditures include construction of 7 new HWRC. In addition, it is assumed that a feasibility study will be carried out along with an analysis of the location of HWRC.

### Cost calculation

- Based on: Recommendations of SWECO Consulting sp. z o. o., Benchmarks Arup, GUS
- The capital expenditure for the construction of 7 HWRCs was based on SWECO recommendations (2018), in which the amount for the construction of one very large HWRC was 1.2 million PLN. This amount was updated with the inflation rate and finally amounted to over 1.3 million PLN. The above estimated amounts of investment expenditure do not include the costs of investment design, land purchase and utility connection.<sup>74</sup> The cost of developing a feasibility study together with a detailed location analysis was estimated on the basis of a benchmark of market offers, many years of experience and extensive knowledge in the implementation of similar projects by the Consultant.

## ID Ok2 HWRC- Household waste recycling centres

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CO1, CO2, CO3, CO4

### Cost calculation cont.

- Operating costs were also based on SWECO recommendations, which indicated the amount of 704 thousand PLN for the operation of one very large HWRC. This amount was updated with the inflation index and finally amounted to 781 thousand PLN. A significant part of operating costs are costs related to the preparation of waste for recycling, its transport and proper management, in accordance with legal requirements.

### Financing mechanism

- Recovery and Resilience Facility
  - B3.4.1. Investments for comprehensive green transformation of cities, 2800 million EUR in loans
- European Funds for Infrastructure, Climate, Environment Program 2021-2027
  - Objective 2.6: Support the transformation towards a closed and resource-efficient economy

- CODE 67. Household waste management: waste prevention, minimization, sorting, reuse, recycling activities, 180 million EUR grants

- Own funds of waste management companies operating in the City
- Own funds of the City

### Action owner

- Waste Management Department**

### Bodies supporting the implementation of action

- Municipal Cleaning Company

### Stakeholders

- Local society
- NGOs related to the ecological cycle of waste and activities to sustain the planet.
- Municipal Water and Sewerage Company in the Capital City of Warsaw S.A. (MPWiK)



## ID Ok2 HWRC- Household waste recycling centres

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CO1, CO2, CO3, CO4
<b>Pre-investment (PLN, EUR)</b>	<b>CAPEX (PLN, EUR)</b>	<b>OPEX (PLN, EUR)</b>
PLN 1 500 000	PLN 9 300 000	PLN 5 470 000
EUR 328 500	EUR 2 041 000	EUR 1 200 000
<b>Estimated savings</b>	<b>Estimated CO<sub>2</sub> emission reduction</b>	<b>% reduction in GHG emissions compared to the 2018 inventory year</b>
-	-	-
<b>% of total CO<sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions</b>		
-		

## ID Ok2 HWRC- Household waste recycling centres

<b>Timescale</b>	<b>Type of action</b>	<b>Short-term objectives of the GCCAP</b>
2023–2030	Capital program	CO1, CO2, CO3, CO4

<b>Steps of implementation</b>	<b>Timeline</b>							
	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>	<b>2030</b>
Identification of the appropriate location of the HWRC								
Feasibility study								
Obtaining financing								
Choosing a contractor								
Design for the construction and construction of a new HWRC, determining the method of operation, waste acceptance, container emptying frequency, and proper waste storage.								
Operation of the new HWRC								

<b>Product indicator</b>	<b>Result indicator</b>
<ul style="list-style-type: none"> <li>• Number of new HWRC points constructed in the city</li> <li>• Construction of 7 new HWRC by 2030</li> </ul>	<ul style="list-style-type: none"> <li>• % increase in the achieved level of municipal waste recycling</li> </ul>

## ID Ok2 HWRC- Household waste recycling centres

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CO1, CO2, CO3, CO4
<b>Action benefits</b>		
<ul style="list-style-type: none"> <li>• Improving the selective collection of municipal waste</li> <li>• Reducing the occurrence of the phenomenon of illegal abandonment and creating the so-called wild fallout dumps</li> <li>• Properly organized collection of hazardous household waste will reduce environmental pollution</li> <li>• Resource efficiency will be increased by reusing and recycling certain items</li> <li>• Including waste collection on an equal basis for all city residents</li> <li>• Reduce the number of illegal landfills</li> <li>• Increase in the level of recycling</li> <li>• Gender equality</li> <li>• Public involvement</li> <li>• Recycling will create new business opportunities and additional jobs in this sector</li> </ul>		
<b>Enabling actions within the Green City and Climate Action Plan of Warsaw</b>		<b>Enabling policies and actions</b>
<ul style="list-style-type: none"> <li>• PS1 Education campaigns</li> </ul>		<ul style="list-style-type: none"> <li>• "Rational Waste Management" program</li> </ul>

## ID Ok2 HWRC- Household waste recycling centres

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Capital program	CO1, CO2, CO3, CO4

Smart potential	Gender and economic inclusion potential
<ul style="list-style-type: none"> <li>Implementation of innovative, automated processes for accepting waste - creating HWRCs with an education zone and a repair and reuse point for non-waste items.</li> </ul>	<ul style="list-style-type: none"> <li>Ensuring balanced participation of representatives of both sexes in the structures of HWRC - especially in the area of decision-making, management, and among technical employees.</li> <li>When designating new HWRC locations, easy access to communication should be taken into account. However, when creating the internal infrastructure of HWRC, the needs of various user groups should be taken into account, including, age and physical fitness.</li> <li>The location of the points should not interfere with the life of the inhabitants, the points should not be burdensome for them or expose them to biological / chemical hazards. It is necessary to use modern technologies of collection and processing of municipal waste that eliminate its negative impact on the environment and possible nuisance.</li> <li>Older and disabled people should receive additional support in delivering waste to HWRCs.</li> </ul>

# Equity and inclusion



## ID PS1 Education campaigns

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2028	Inclusive action	CT4, CE1, CE2, CB1, CB2, CB3, CO1, CO2, CO3, CR1, CR2, CR3

### Description

Public awareness campaigns about the activities implemented in the GCCAP. Implementation of new activities as well as expansion and continuation of existing educational campaigns, including activities carried out under the GCCAP in individual thematic areas.

Campaigns will include, among others:

- raising awareness of residents about energy saving practices and solutions, energy in a world of electric mobility and sustainable transport, water consumption and protection of biodiversity,
- implementation of solutions in the field of blue - green infrastructure (local and supra-local operating throughout the city), continuous, simple and accessible environmental education for residents, building managers and administration,
- raising awareness and motivation to reduce waste generation and better segregate waste at source.

Campaigns will also address the need for transport and land use messages that provide information and rationale to drivers, cyclists and walkers to understand and prepare for (or take advantage of) the upcoming changes.

Training is necessary for newly required skills, such as for specialists in the thermomodernisation process (from auditors to thermomodernisation contractors). The city would work with vocational training institutions to create and extend training programs in parallel with the implementation of financial measures providing employment opportunities for the growing campaign and education area.

The task will also include dripping and continuation of ongoing campaigns aimed at neighbouring municipalities to exchange knowledge and implemented solutions.

### Background and justification

The GCCAP proposes the implementation of new and the continuation and support for the city's ongoing initiatives. The success of the changes implemented and the change in user behavior depends in part on a sustained and effective campaign, talks, and communication at all levels - from strategic city plans

plans to messages and promotions carried out on the streets, on buses and on social media. It is important to continue and expand successful campaigns and to create new campaigns for newly implemented solutions.

### The scale of action / notes on the estimate

The average cost of implementing 10 educational campaigns, estimated on the basis of sample public procurement for the implementation of an educational campaign on environmental issues in Warsaw.

### Cost calculation

- Based on: Benchmark of public procurement of Institute of Environmental Protection. National Research Institute (IOŚ-PIB), Budget of the Capital City of Warsaw 2021
- The average amount estimated on the basis of the benchmark for the preparation of an educational campaign in Warsaw was 1.25 million PLN. The amounts for the preparation of campaigns with a similar range and environmental themes ranged from 800,000 PLN to 1.95 million PLN.

## ID PS1 Education campaigns

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2028	Inclusive action	CT4, CE1, CE2, CB1, CB2, CB3, CO1, CO2, CO3, CR1, CR2, CR3

### Financing mechanisms

- LIFE Program (grants awarded by the European Commission, the contact point in Poland is National Fund for Environmental Protection and Water Management), grants
- Grants from National Fund for Environmental Protection and Water Management and Voivodeship Fund for Environmental Protection and Water Management
- Own funds of the City

### Action owner

- **Centre for Public Communication**

### Bodies supporting the implementation of action

- Waste Management Department
- City Marketing Department
- Air Protection and Climate Policy Department
- Environmental Protection Department
- Infrastructure Department
- Architecture and Spatial Planning Department
- Road Traffic Management Department
- Municipal Water and Sewerage Company
- The Greenery Management of the Capital City of Warsaw

### Stakeholders

- Local society
- Private and municipal enterprises
- NGOs related to the ecological cycle of waste and activities to sustain the planet.

Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
PLN 12 500 000	-	-
EUR 2 700 000	-	-
Estimated savings	Estimated CO <sub>2</sub> emission reduction	% reduction in GHG emissions compared to the 2018 inventory year
-	-	-
% of total CO <sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions		
-		

## ID PS1 Education campaigns

<b>Timescale</b>	<b>Type of action</b>	<b>Short-term objectives of the GCCAP</b>
2023–2028	Inclusive action	CT4, CE1, CE2, CB1, CB2, CB3, CO1, CO2, CO3, CR1, CR2, CR3

<b>Steps of implementation</b>	<b>Timeline</b>					
	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>
Analysis of areas that require education and promotion of pro-ecological attitudes in society						
Choosing the right medium to reach the largest possible audience						
Selection of the entity that will implement the provisions of the educational campaigns						
Implementation of selected educational campaigns, continuation and extension of selected educational campaigns						

<b>Product indicator</b>	<b>Result indicator</b>
<ul style="list-style-type: none"> <li>• Number of new educational campaigns implemented</li> <li>• Number of existing educational campaigns continued and extended</li> <li>• Running a minimum of 10 education campaigns by 2028</li> </ul>	<ul style="list-style-type: none"> <li>• Number of promotional campaigns concerning the implemented solutions under the Green City and Climate Action Plan of Warsaw</li> </ul>



## ID PS1 Education campaigns

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2028	Inclusive action	CT4, CE1, CE2, CB1, CB2, CB3, CO1, CO2, CO3, CR1, CR2, CR3

### Action benefits

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• Improving society's knowledge of specific attitudes to protect the environment</li> <li>• Increasing the awareness of residents about their impact on the external environment</li> <li>• Shaping responsible attitudes of residents favouring the good of the surrounding environment</li> </ul> | <ul style="list-style-type: none"> <li>• Economic integration</li> <li>• Gender equality</li> <li>• Social involvement</li> <li>• Improving the quality of life of residents</li> <li>• Creation of new jobs</li> </ul> |
|--|---|

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- E7 Creation of a Sustainable Investments Fund
- R1 Increasing biologically active surfaces and removing impermeable surfaces
- Ok2 HWRC - Household waste recycling centres
- R2 Protection and restoration of valuable green areas
- R3 Preservation & restoration of urban greenery Zakole Wawerskie
- R4 Greening streets and sustainable transport program

### Enabling policies and actions

- Strategy #Warszawa2030
- Warsaw Climate Panel (recommendations: Development and implementation of social campaigns addressed to various groups of Warsaw residents, the aim of which is to increase environmental awareness; Development of a broad educational program raising awareness of the Warsaw community on counteracting climate change and adapting; Educational activities (action program) for residents communities, housing estates, especially making people aware of why should switch to RES).

## ID PS1 Education campaigns

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2028	Inclusive action	CT4, CE1, CE2, CB1, CB2, CB3, CO1, CO2, CO3, CR1, CR2, CR3

Smart potential	Gender and economic inclusion potential
<ul style="list-style-type: none"> <li>• implementation of educational campaigns carried out on diversified mass media platforms; television, internet, radio,</li> <li>• development of applications and financial incentives (e.g., discounts to local stores) to use non-motorized forms of transport in the city, thanks to the use of existing applications, e.g., Veturilo, or the creation of a dedicated application,</li> <li>• development of application for energy management awareness at the household level.</li> </ul>	<ul style="list-style-type: none"> <li>• when formulating the message, one should take into account the diversity of recipient groups by gender, age, socio-economic group, belonging to a minority. The messages should be non-exclusive and not burdened with stereotypes in these areas. The message of the campaign should be inclusive and activating, focused on commitment and interaction,</li> <li>• messages should be provided in a form that is friendly to the visually impaired, hearing impaired, and with other perception disorders / imperfections and be widely available,</li> <li>• when planning the use of specific carriers, one should take into account the different media use patterns of different target groups - including the older and the youngest generation of recipients (e.g., including Tik Tok in the campaign), as well as groups that do not speak Polish at the native user level,</li> <li>• promoting and popularizing universal design,</li> <li>• the campaigns should involve organizations / communities / NGOs representing interests and gathering members of various communities, including female, minority - ethnic, national, cultural, religious, LGBTQ + and others, as well as disabled people, users of various vehicles, civil society organizations and those related to ecology and the fight against climate change.</li> </ul>

## ID PS2 Tackling energy poverty

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Inclusive action	CE1, CE2, CE4, CB2, CB3

### Description

As part of the implemented GCCAP activities, it is important to implement dedicated activities aimed at counteracting energy poverty through systems of fees, subsidies, and discounts. It is important to implement actions which do not create solutions that exclude any user groups, and which take care to create equal opportunities for their functioning, as well as to develop the inhabitant's own awareness of energy consumption. Counteracting energy poverty indirectly brings benefits in the form of reducing health expenses, reducing air pollution (by replacing heating sources that are not suitable for the assumed goals), improving comfort and well-being, as well as improving household budgets.

As part of the action, it will be important to assess the scale of the existing funds and programs to counter energy poverty and to create additional activities and funds dedicated to actions implemented in the city. It will be important to develop energy poverty indicators, ways of monitoring them and working towards reducing the scale of energy poverty.

### Background and justification

The GCCAP proposes the continuation of existing and the creation of new initiatives of the city to prevent the deepening of the phenomenon of energy poverty among the city's residents. It is important to take care of the inclusivity of solutions, observe and predict which social groups require a support program.

In April 2022 Warsaw joined the C40 program: Emergency Plan to Tackle the European Energy Crisis and Protect Residents. The program will help prepare immediate action plan to address the energy crisis, problem of reliance on fossil fuels and potential of growing levels of energy poverty.

### The scale of action / notes on the estimate

The estimated amount of capital expenditure is the cost of implementing projects related to the reduction of pollutant emissions into the air and improving the energy efficiency of buildings through the implementation of low-emission projects for the benefit of the least affluent households in single-family residential buildings, including in particular those, whose members are persons entitled to receive cash benefits under the Act of 12 March 2004 on social assistance.

### Cost calculation

- Report „Energy poverty in Poland, with particular emphasis on people living in single-family houses”, Institute for Structural Research, April 2018, [Czystepowietrze.gov.pl](http://Czystepowietrze.gov.pl), Local Data Bank.
- Capital expenditure is the cost of implementing investments related to low-emission projects under the Stop Smog program. It was assumed that 1 apartment = 1 household. The housing resources of the City of Warsaw in 2020 amounted to 1,020,433 dwellings, of which 81,377 are communal (municipal) housing resources. The estimated number of energy poverty households in this sector is approximately 6,344. The number of private sector dwellings, in this case, is 939,096. Of which, the estimated number of households affected by poverty is 73,249. An amount of 53,000 PLN has been allocated for each household to implement low-carbon projects.

## ID PS2 Tackling energy poverty

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Inclusive action	CE1, CE2, CE4, CB2, CB3

### Cost calculation cont.

- According to the above-mentioned report, energy poverty in households living in single-family houses, in cities with more than 100,000 inhabitants of inhabitants affects 7.8% of all households. The average cost of implementing a low-emission project in one building, and in the case of a building with two units - in one unit, may not exceed PLN 53,000.

### Financing mechanisms

- National Recovery Plan
  - B3.4.1 Investments in comprehensive green transformation of cities, 2800 million EUR, loans,
- National Fund for Environmental Protection and Water Management, "Stop Smog" Program, 518 million PLN, grants,
- Own funds of the City.

### Action owner

- Air Protection and Climate Policy Department

### Bodies supporting the implementation of action

- Welfare and Social Projects Department

### Stakeholders

- local society
- private and municipal enterprises
- NGOs with a circular economy and actions for sustainable development

Pre-investment (PLN, EUR)	CAPEX (PLN, EUR)	OPEX (PLN, EUR)
-	Municipal sector <ul style="list-style-type: none"> <li>• PLN 336 200 000</li> <li>• EUR 73 600 000</li> </ul> Private sector <ul style="list-style-type: none"> <li>• PLN 3 882 000 000</li> <li>• EUR 850 100 000</li> </ul>	-
<b>Estimated savings</b>	<b>Estimated CO<sub>2</sub> emission reduction</b>	<b>% reduction in GHG emissions compared to the 2018 inventory year</b>
-	-	-
<b>% of total CO<sub>2</sub> emission reduction from proposed Green City and Climate Action Plan of Warsaw actions</b>		
-		

## ID PS2 Tackling energy poverty

Timescale	Type of action		Short-term objectives of the GCCAP					
2023–2030	Inclusive action		CF1, CF2, CF4, CB2, CB3					
<b>Steps of implementation</b>	<b>Timeline</b>							
	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>	<b>2030</b>
Analysis and evaluation of the energy needs and requirements of the inhabitants of Warsaw								
Legislative activities of the City Council and the State enabling the introduction of the assumptions of the action								
Implementation of the program assumptions								
Program implementation monitoring								
<b>Product indicator</b>				<b>Result indicator</b>				
<ul style="list-style-type: none"> <li>amount of funds allocated to financial assistance to households suffering from energy poverty</li> <li>financially support at least half of the 79,593 households (private and communal together) affected by energy poverty by 2030.</li> </ul>				<ul style="list-style-type: none"> <li>% decrease in households affected by energy poverty</li> </ul>				

## ID PS2 Tackling energy poverty

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Inclusive action	CE1, CE2, CE4, CB2, CB3

### Action benefits

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>• increasing the quality and comfort of life of the inhabitants</li> <li>• improvement of air quality and energy efficiency (reduction of solid fossil fuel heating sources)</li> <li>• energy saving solution to improve energy efficiency</li> <li>• economic integration</li> </ul> | <ul style="list-style-type: none"> <li>• improvement of living conditions and comfort</li> <li>• decreasing the share of costs allocated to energy in the entire household budget</li> <li>• increase in the value of residential buildings</li> <li>• reducing the negative impact on the external environment</li> </ul> |
|---|--|

### Enabling actions within the Green City and Climate Action Plan of Warsaw

- B2 Program to improve the energy efficiency of municipal buildings with a pilot
- B3 Continued replacement of high-emission heat sources.

### Enabling policies and actions

- program for improving the energy efficiency of municipal buildings and subsidies for further modernization of residential buildings
- STOP SMOG - Clean Air Program
- Warsaw Climate Panel (recommendation: Launching a support system for owners of buildings (including heritage) in the deep thermomodernization process, in the form of a social campaign and a technical advisory system as well as support in the organization of financing, first targeting the most energy-consuming ones).

## ID PS2 Tackling energy poverty

Timescale	Type of action	Short-term objectives of the GCCAP
2023–2030	Inclusive action	CE1, CE2, CE4, CB2, CB3

Smart potential	Gender and economic inclusion potential
<ul style="list-style-type: none"> <li>• development of solutions that can define and monitor the scale of energy poverty among residents, based on socio-economic data,</li> <li>• development of innovative business models and financing scheme to improve the access of low-income household to modern energy services such as thermal solar solutions, which can be coupled with a pay as you go financing scheme (to avoid credit mechanisms for lower income households).</li> </ul>	<ul style="list-style-type: none"> <li>• when planning solutions aimed at counteracting energy poverty, the needs in this regard should be taken into account in terms of gender, age, and specificity of excluded groups (e.g., ethnic minorities), social and economic aspects of households, spatial diversity and building characteristics.</li> </ul>

# Appendix B

Review of applicable regulations and development programming documents





## Review of applicable regulations and development programming documents

Table 23. Plans, programmes and strategies – International level

Name of the document	Developed by	Implications for the Green City and Climate Action Plan of Warsaw
<b>United Nations Framework Convention on Climate Change (UNFCCC) and Paris Agreement under UNFCCC</b>	United Nations	During the development of the GCCAP, consideration have given to Warsaw’s carbon budget in order to be consistent with its share in EU’s Nationally Determined Contributions (NDC). Poland as the European Union Member State has not been obliged to present individual NDC. The EU and its Member States’ NDC is as follows: the EU and its Member States, acting jointly, are committed to a binding target of a net domestic reduction of at least 55% in greenhouse gas emissions by 2030 compared to 1999.
<b>UN Transforming our world: the 2030 Agenda for sustainable development</b>	United Nations	Actions specified in the GCCAP are consistent with selected SDGs mainly: sustainable development of the city and its community, clean water and an efficient sewage network, climate action, affordable and clean energy, responsible consumption and production, industry, innovations and infrastructure.
<b>Geneva Convention on Long-Range Transboundary Air Pollution</b>	United Nations Economic Commission for Europe	Actions under the Green City and Climate Action Plan of Warsaw take into account the assumptions and obligations arising from the Convention and related protocols, which relate to the development of policies and strategies for counteracting air pollution.
<b>The Bern Convention on the Conservation of European Wildlife and Natural Habitats</b>	Council of Europe	Actions in the GCCAP that may affect wildlife and natural habitats will need to consider the provisions of this Convention. Protecting and sustaining Warsaw’s natural habitats is essential to the GCCAP. Actions should consider scope for enhancement or restoration and avoid negative impacts on protected sites.

## Review of applicable regulations and development programming documents

Table 24. Plans, programmes and strategies – EU level

Name of the document	Developed by	Implications for the Green City and Climate Action Plan of Warsaw
<b>EU Climate Neutral and Smart Cities</b>	European Commission	The Mission aims to promote system innovation across the value chain of city investment, targeting multiple sectors such as governance, transport, energy, construction and recycling, with support from powerful digital technologies. In accordance with the mission, the approach to the practical aspects of investment implementation should be changed, as well as to cooperating units and organizations: citizens, local governments, central and regional authorities.
<b>European Green Deal (2019)</b>	European Commission	It is the most important EU Growth Strategy for the coming decade in the area of sustainable development, which targets and initiative should be taken into account in the GCCAP implementation.
<b>Directive (EU) 2016/2284 of the European Parliament and of the Council on the reduction of domestic emissions of certain types of atmospheric pollutants; Amending of Directive 2003/35 /EC and repealing Directive 2001/81 /EC</b>	The European Parliament and the Council of the European Union	Compliance with the quality standards must be ensured, when implementing actions in the Green City and Climate Action Plan of Warsaw on urban transport and on other actions, which may impact air quality.
<b>Directive 2008/50/EC on ambient air quality and cleaner air for Europe (CAFE Directive)</b>	The European Parliament and the Council of the European Union	Compliance with the air quality standards must be ensured when implementing actions in the Green City and Climate Action Plan of Warsaw on sectors, which may impact air quality. The GCCAP complies with standards and provisions provided in the Polish laws implementing EU legislation (Environmental Protection Act, related ordinances).
<b>Directive 2018/2001/EC on the promotion of the use of energy from renewable sources (RES Directive)</b>	The European Parliament and the Council of the European Union	The GCCAP includes actions aimed at the promotion of use of renewables in order to contribute to achieving the targets set by the Directive.
<b>Directive on the conservation of natural habitats and of wild fauna and flora 92/43/EEC (Habitats Directive)</b>	The Council of the European Communities	Protecting and sustaining natural habitats on the territory of Warsaw Municipality is essential to the GCCAP. Actions consider the scope for enhancement or restoration of protected areas and avoid negative impacts on protected sites.

## Review of applicable regulations and development programming documents

Table 24. Plans, programmes and strategies – EU level

Name of the document	Developed by	Implications for the Green City and Climate Action Plan of Warsaw
<b>Directive on the conservation of wild birds 2009/147/EC (Wild Birds Directive)</b>	The European Parliament and the Council of the European Union	The protection and maintenance of wildlife are important in terms of implementing the provisions of the Green City and Climate Action Plan of Warsaw. The activities include a number of assumptions that will make it possible to avoid negative impacts on the habitats of protected species.
<b>Waste Directive 2018/851/EC (amending Directive 2008/98/EC on waste)</b>	The European Parliament and the Council of the European Union	Actions on waste consider key principles of the above-mentioned Directive, as well as other targets coming from other Directives dedicated to waste management. The Green City and Climate Action Plan of Warsaw complies with standards and provisions provided in the Polish laws implementing EU legislation (Waste Act).
<b>Directive on the assessment and management of flood risk 2007/60/EC (Floods Directive)</b>	The European Parliament and the Council of the European Union	The Green City and Climate Action Plan of Warsaw considers actions aimed at the reduction of flood risk including sustainable land use practices in the flood risk areas in Warsaw. The implementation of the assumed activities should not create additional risk.
<b>Directive 2018/2002/EC amending Directive 2012/27/EU on energy efficiency (EED)</b>	The European Parliament and the Council of the European Union	The GCCAP proposes specific measures and solutions that can guarantee significant financial savings and increase energy efficiency.

## Review of applicable regulations and development programming documents

Table 25. Plans, programs and strategies in force at national, regional and transregional level

Name of the document	Developed by	Implications for the Green City and Climate Action Plan of Warsaw
<b>Strategy for Responsible Development up to 2020 with a 2030 perspective - "SRD"</b>	The Council of Ministers	On the horizontal level, the Strategy should impact the Green City and Climate Action Plan of Warsaw and its implementation mainly in the areas of energy, transport and environment, as well as their financing.
<b>National Environmental Policy by 2030 - "PEP 2030"</b>	The Council of Ministers	As PEP2030 is the most important strategy in terms of environment and climate protection, its objectives and specified measures should be taken into account in the process of the GCCAP implementation.
<b>Polish Energy Policy to 2040 – "PEP 2040"</b>	The Council of Ministers	As PEP2040 is the most important strategy in terms of energy, its objectives and specified measures should be taken into account in the process of the Green City and Climate Action Plan of Warsaw implementation.
<b>Development Strategy for the Mazowieckie Voivodeship 2030+</b>	Sejmik of the Mazowieckie Voivodeship	<p>The document is an answer to the challenges, which the region needs to face in order to improve the quality of life, reduce social exclusion and unemployment, strengthen territorial cohesion and develop in an intelligent and sustainable manner.</p> <p>As it is the most important strategy for the development of the Masovian Voivodeship, its goals and objectives should be taken into consideration in the process of the preparation and the implementation of the Green City and Climate Action Plan of Warsaw.</p>
<b>The Spatial Development Plan of Mazowieckie Voivodeship</b>	Sejmik of the Mazowieckie Voivodeship	The Plan is the planning act, which determines the principles of spatial organization of the voivodeship. It defines the basic elements of the spatial arrangement, their diversification and mutual relations. It outlines the directions of spatial policy, which together with the spatial conditions, are taken into consideration in development programs and operation programs of the voivodeship. It should be analyzed in the process of the Green City and Climate Action Plan of Warsaw preparation.

## Review of applicable regulations and development programming documents

Table 25. Plans, programs and strategies in force at national, regional and transregional level

Name of the document	Developed by	Implications for the Green City and Climate Action Plan of Warsaw
<b>Air protection program for zones in the Mazowieckie Voivodeship where the permissible and target levels of substances in the air have been exceeded.</b>	Sejmik of the Mazowieckie Voivodeship	The Program should be considered as one of the most important documents in the implementation of the Green City and Climate Action Plan of Warsaw in the area of air protection. The Green City and Climate Action Plan of Warsaw should be consistent with the main tools and activities specified in the Program.
<b>Resolution No. 162/17 of the Sejmik of the Mazowieckie Voivodeship of 24 October 2017 on the introduction of restrictions and bans on the operation of installations in which fuel combustion takes place in the territory of the Mazowieckie Voivodeship</b>	Sejmik of the Mazowieckie Voivodeship	The resolution underlines a prohibition of using certain fossil fuel type in individual heat sources like stoves, fireplaces and furnaces from 1 July 2018 and it requires a replacement of furnaces by specified deadlines.
<b>Waste Management Plan for Mazowieckie Voivodeship by 2024</b>	Sejmik of the Mazowieckie Voivodeship	The Plan should be considered as one of the most important documents in the implementation of the Green City and Climate Action Plan of Warsaw in the area of waste management. The targets and measures, which are set out in the Plan should be taken in consideration when implementing the Green City and Climate Action Plan of Warsaw.
<b>The Strategy for the Integrated Territorial Investments for the Warsaw Functional Area 2014-2020+</b>	the City of Warsaw in cooperation with city and communal offices of the Warsaw Functional Area	The Strategy indicates projects planned for implementation within EU funds designated in the Regional Operational Program of the Mazowieckie Voivodeship for 2014-2020. It is also an implementing document for the Strategy for the Development of the Warsaw Metropolitan Area until 2030. Implemented projects should be analysed as a background for potential Green City and Climate Action Plan of Warsaw investments.

## Review of applicable regulations and development programming documents

Table 25. Plans, programs and strategies in force at national, regional and transregional level

Name of the document	Developed by	Implications for the Green City and Climate Action Plan of Warsaw
<b>Strategy for Sustainable Development of Transport until 2030</b>	The Council of Ministers	The main objective of the document is to improve the safety of road users and the efficiency of the transport sector by creating a coherent, sustainable, innovative and user-friendly transport system, which should be taken into account in the implementation of the Green City and Climate Action Plan of Warsaw.
<b>Regulation of the Minister of Infrastructure of 4 December 2020 on the plan for sustainable development of public collective transport in inter-voivodeship and international passenger transport and in provincial passenger transport in rail transport</b>	Ministry of Infrastructure	The assumptions of the plan regarding the development of public collective transport should be included in the process of implementing the Green City and Climate Action Plan of Warsaw.
<b>Long-term National Development Strategy "Poland 2030. The Third Wave of Modernity"</b>	Ministry of Administration and Digitization	The directions of intervention included in the Strategy include development of innovation in the economy and digitization, human capital, energy and environmental security, transport. These issues should be taken into account in the process of implementing the Green City and Climate Action Plan of Warsaw.
<b>National Spatial Development Concept 2030</b>	The Council of Ministers	The National Spatial Development Concept 2030 (KPZK 2030) is the most important national strategic document concerning the spatial development of the country. The document presents a vision of the country's spatial development in the perspective of the next twenty years, specifies the goals and directions of the country's development policy aimed at its implementation, and indicates the principles and mechanisms of coordination and implementation of public development policies with a significant territorial impact. The assumptions of the concept, its goals and assumptions should be taken into account in the process of implementing the Green City and Climate Action Plan of Warsaw.

## Review of applicable regulations and development programming documents

Table 25. Plans, programs and strategies in force at national, regional and transregional level

Name of the document	Developed by	Implications for the Green City and Climate Action Plan of Warsaw
<b>Act on electromobility and alternative fuels - passed by the Sejm on January 11, 2018, as amended</b>	Parliament	The Act defines the rules for the development and operation of infrastructure for the use of alternative fuels in transport, the obligations of public entities in the field of the development of alternative fuels infrastructure and the conditions for the operation of clean transport zones. The provisions of the act are extremely important in the context of implementing the assumptions of the GCCAP, whose scope of activities covers the subject of electromobility and the implementation of clean transport zones.
<b>Regional Transport Plan for the Mazowieckie Voivodeship until 2030</b>	Sejmik of Mazowieckie Voivodeship	The objectives and tasks set out in the Plan should be taken into account in the process of implementing the Green City and Climate Action Plan of Warsaw.

## Review of applicable regulations and development programming documents

Table 26. Municipal existing documents

Name of the document	Implications for the Green City and Climate Action Plan of Warsaw
<b>#Warsaw 2030 Strategy (Development strategy for the capital city of Warsaw until 2030)</b>	As the Strategy defines the capital city development policy by 2030, its objectives should be taken into account in the process of the Green City and Climate Action Plan of Warsaw implementation.
<b>Study of the conditions and directions of spatial development of the City of Warsaw</b>	The Study presents the conditions and directions of spatial development that should be taken into account in the implementation of the GCCAP. They are binding for local spatial development plans. The city is currently working on a new Study, which is planned for adoption in the current term of the Warsaw City Council.
<b>Integrated Revitalization Program by 2022</b>	The Green City and Climate Action Plan of Warsaw takes into account the objectives of the Program as a key document in the revitalization sector. Currently a new Integrated Revitalisation Program for the City of Warsaw is being developed.
<b>Environmental Protection Program for the City of Warsaw for the years 2021-2024</b>	The Green City and Climate Action Plan consists of numerous actions and measures to improve the state of the environment as well as actions related to climate change mitigation and adaptation. These actions and long-term goals are in line with the main objectives of the Programme.
<b>The Climate Change Adaptation Strategy for the city of Warsaw by 2030 with the prospects until 2050</b>	The Strategy should be considered as a key document in the implementation of the Green City and Climate Action Plan in the area of adaptation to climate change and taken into account in the Green City and Climate Action Plan implementation.
<b>Urban Adaptation Plan</b>	
<b>Warsaw Low Carbon Economy Plan</b>	The Plan should be considered as one of the important documents in the implementation of the GCCAP in the area of low carbon economy.



## Review of applicable regulations and development programming documents

Table 26. Municipal existing documents

Name of the document	Implications for the Green City and Climate Action Plan of Warsaw
<b>Sustainable Energy Action Plan for Warsaw in the perspective of 2020 (SEAP)</b>	This Plan was analysed in the preparation of the GCCAP. However, the preparation of the SECAP for Warsaw which would underline both mitigation and adaptation measures should be undertaken.
<b>Environmental Protection Program against Noise for the City of Warsaw</b>	The GCCAP should be assessed in terms of the protection of environment against noise. The measures which are defined in the Programme need consideration upon the implementation of the GCCAP.
<b>Development policy of the water and sewage system in Warsaw until 2025</b>	This policy is a document in the field of water and wastewater management, therefore its objectives and actions should be taken into account in the process of the GCCAP implementation.
<b>Long-term Plan for the Development and Modernization of Water Supply Equipment and Sewerage Equipment of the Municipal Water and Sewage Company in the Capital City of Warsaw S.A. for the years 2022-2030 concerning the capital city of Warsaw, communes: Michałowice, Nieporęt, Raszyn, Serock, Wieliszew and the cities of Piastów and Pruszków</b>	As the Plan specifies the concrete investments for the expanding of the water supply and sewage systems in Warsaw, it should be analyzed in the GCCAP implementation.

## Review of applicable regulations and development programming documents

Table 26. Municipal existing documents

Name of the document	Implications for the Green City and Climate Action Plan of Warsaw
<b>The Transportation system of Warsaw: Sustainable Development Strategy up to the year 2015 and successive years including The Sustainable Development Plan for Warsaw's Public Mass Transit System</b>	The goals and objectives defined in the Strategy should be taken into consideration in the process of the implementation of the GCCAP, however as a background document.
<b>Plan for the sustainable development of public transport for the capital city Warsaw, taking into account public collective transport organized on the basis of agreements with neighboring communes</b>	The "Transport Plan" creates the basic assumptions for the organization of collective public transport organized or co-organized by Warsaw. The plan states that public transport services should be organized at the highest possible level and be as accessible as possible - both in terms of space and functionality. They must take into account the needs of disabled people and people with reduced mobility. The objectives and tasks set out in the Plan should be taken into account in the process of implementing the GCCAP, however, as a supporting document.
<b>Order of the President of the Capital City of Warsaw No. 1682/2017 of October 23, 2017 on the creation of accessible space in the capital city of Warsaw, including infrastructure for pedestrians with particular emphasis on people with reduced mobility and perception</b>	The regulation defines and introduces for the planning, design, reconstruction and renovation of infrastructure and urban space: „Accessibility standards for the capital city of Warsaw ", " Design and implementation standards for pedestrian infrastructure in the capital city of Warsaw ", " Design and implementation guidelines for pedestrian infrastructure in the city in the capital city of Warsaw ". Standards and guidelines must be taken into account at the stage of implementing the assumptions of the GCCAP.
<b>Warsaw Action Program for People with Disabilities until 2027</b>	The mission and tasks specified in the Program should be included in the process of implementing the GCCAP.

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## Review of applicable regulations and development programming documents

Table 26. Municipal existing documents

Name of the document	Implications for the Green City and Climate Action Plan of Warsaw
<b>Warsaw Climate Panel</b>	The recommendations of the Warsaw Climate Panel from the beginning of the GCCAP project were identified as a significant contribution from the social side and external stakeholders. As part of the project, after assessing the condition of the existing city, a series of meetings with external stakeholders focused on setting the direction of activities and significant goals in the city's development, including non-governmental organizations, city movements and entrepreneurs, were conducted. During these meetings, the similarities between the GCCAP and the Climate Panel were discussed. The activities developed under the GCCAP will be a tool to achieve climate neutrality in Warsaw by 2050, which essentially corresponds to the assumptions of the recommendations of the Warsaw Climate Panel. The links between the activities developed under the RCD and the recommendations are presented on the next page.

## Review of applicable regulations and development programming documents

Table 27. Links between the actions developed under the Green City and Climate Action Plan of Warsaw and the recommendations of the Warsaw Climate Panel

Operation within the GCCAP	Related recommendations of the Warsaw Climate Panel
<b>ID E2 Generation of green Energy by the city within and outside Warsaw's borders</b>	Analysis of local RES energy generation possibilities by collective prosumers and energy cooperatives; installation by 2030 of photovoltaic panels on the roofs of all buildings belonging to the city, including Park and Ride car parks and city depots, if there is a technical, architectural and conservation possibility to install them).
<b>ID E7 Establishment of a Sustainable Energy Investments Fund</b>	Driving by the city "positive energy motivation" at the district level and raising additional investment money for the district in return for reducing energy consumption or increasing energy efficiency.
<b>ID B1 Preparation and support for implementation of the best practices and instructions for building thermomodernization and construction</b>	Creation of the Warsaw Green Building Standard, which is a set of principles, requirements and guidelines leading to the achievement of urban climate goals in the construction sector.
<b>ID B2 Program to improve the energy efficiency of municipal buildings with a pilot</b>	Implement an energy management system in all municipal public buildings based on the PN-EN ISO 50001 Energy Management Standards.
<b>ID B3 Continued replacement of high-emission heat sources</b> <b>ID PS2 Tackling energy poverty</b>	Launch a system of support for building owners (including historic buildings) in the process of Deep Thermal Modernization, in the form of a public campaign and a system of technical advice and support in organizing financing, targeting the most energy-intensive first).
<b>ID R1 Increasing biologically active surfaces and removing impermeable surfaces</b>	De-concrete and increase the proportion of biologically active area in built-up areas through incentives for private property owners and managers, cooperation and joint ventures with managers of public properties not under City management.
<b>ID PS1 Education campaigns</b>	Development and implementation of social campaigns addressed to various groups of Warsaw residents, the aim of which is to increase environmental awareness; Development of a broad educational program raising awareness of the Warsaw community on counteracting climate change and adapting to it; Educational activities - a program of activities for residents of communities, housing estates, especially raising awareness of why to switch to renewable energy.

# Appendix C

Emission inventory and climate action scenarios  
in the next 30 years



# Emission inventories and climate action scenarios over a 30-year horizon

## C.1 Scenarios for climate action in a 30-year horizon

Warsaw's target is to reach net-zero emissions by 2050 and reduce emissions 40% by 2030 compared to 2007 (which relates to around 35% reduction compared to 2018).

To develop an evidence base which can link these targets to the strategies in the GCCAP and Warsaw's emissions profile, the city undertook an exercise to model its emissions and these strategies over time in the C40 'Pathways tool'. The objective of the process is to demonstrate a robust pathway to meeting its targets and identifying the level of strategy implementation required.

The following scenarios were developed:

### BAU Scenario (*Business-as-usual Scenario*):

A 'no-climate-action' forecast of emissions, which takes account of forecasted city growth in GDP, used as a reference from which to benchmark strategies which reduce emissions.

**GCCAP Scenario:** Includes strategies that are ambitious yet achievable measures over a 30-year horizon.

**Extended Scenario:** Identifies the strategies that would be required to close the gap between the 'GCCAP' scenario and required level to meet a fair-share 1.5 degrees warming scenario for Warsaw (as defined by C40 'Deadline 2020').

The scenarios are described in more detail on the following pages.

The developed identification of GHG emissions allowed the identification of those sectors which urgently require action to achieve long-term goals.

Among the sectors with the greatest impact in terms of GHG emissions, the following were distinguished:

- energy system - due to the energy mix in the network,
- buildings - the energy efficiency of the buildings,
- transport - both public and private.

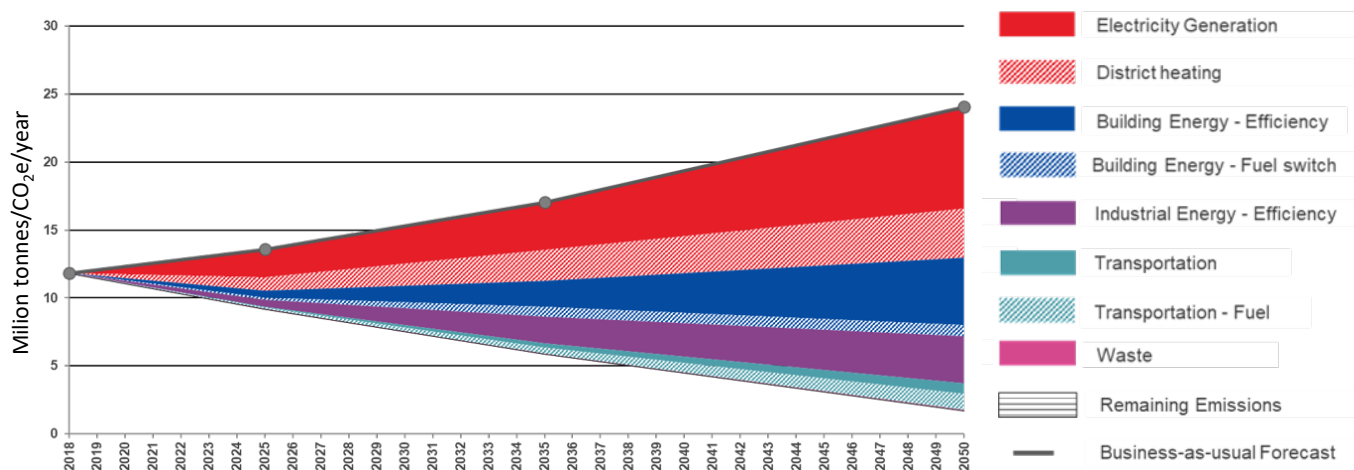


Figure 16. Warsaw's citywide GHG tonnes of emissions per year over the 4 horizon years in the model and how they grow (2018-2025-2035-2050) - potential of selected actions under GCAP scenario.

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## Emission inventories and climate action scenarios over a 30-year horizon

### C.1 Scenarios for climate action in a 30-year horizon

Sectors with the highest share in GHG emissions were identified. Their impact on the environment and the pursuit of the city's climate neutrality is of decisive importance and, in parallel, with adaptation measures related to the development and protection of existing naturally functioning areas, have been identified as themes where actions should be taken in the short term so that the effects can be seen as early as 2030.

Two-track actions - mitigation and adaptation, with the use of blue - green infrastructure - will help the city in its pursuit of the green and low-emission transformation of Warsaw.



Photo: City of Warsaw

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## Emission inventories and climate action scenarios over a 30-year horizon

### C.2 Emission pathways. GCCAP Reduction Scenario for energy

#### Energy

Transforming **Warsaw's energy system** is the most impactful strategy area to reduce emissions in the city. Action in the area is crucial given the current reliance on coal generation in the national grid. Also, the district heating network which provides heat to the majority of buildings in Warsaw and provides electricity from CHP to meet 60% of the total demand of the city, is served by coal-based power plants.

The **decarbonisation of electricity** is fundamental to the City of Warsaw's drive towards climate neutrality, as it will enable further reductions in CO<sub>2</sub> emissions in the areas of transport and heating. In these sectors, it is necessary to strive for a transition to electricity and to further increase energy efficiency.

For the GCCAP, three strategy areas are seen by the city as essential to decarbonise electricity:

- Grid decarbonisation;
- Decarbonisation of the district heating network;
- Distributed renewables (PV).

The national policy 'Poland Energy Outlook' forecasts that the proportion of coal share in electricity generation can decline significantly by 2040, however as detailed by the IEA and others, coal must be phased out of advanced economies (OECD, including Poland, plus 5 others) by 2030, and worldwide by 2040, to meet net zero by 2050. In the **GCCAP Reduction Scenario** for the years 2025 and 2035, forecasts of changes in fuel use in the energy mix for the existing national grid were used. However, the goal of achieving zero carbon consumption in the electricity system by 2050 was added, which after consultation with stakeholders was considered a feasible action that the city can support.

The operator of the district heating network in Warsaw is Veolia and is principally reliant on heat generated at two power plants:

- Siekierki (providing 51% of the network's heat in 2018);
- Żerań (39%).

PGNiG Termika is developing a comprehensive strategy to phase out coal usage by 2035 and transition to low and zero-emission fuels.

This will involve investments in the Żerań Electricity and Heat Plant to replace 9 coal boilers with new gas units, as well as the construction of modern low-emission gas units and zero-emission electrode boilers at the Siekierki Electricity and Heat Plant. In the remaining PGNiG Termika plants operating at peak times, new investments are planned, such as replacing coal with gas at the Kawęczyn Heat Plant. PGNiG Termika intends to make widespread use of waste heat through the implementation of large-scale heat pumps. These planned actions by PGNiG Termika will contribute to achieving a zero-energy balance for Warsaw by 2050, and the city will continue to provide supportive measures and broad-based support for these changes. The transition from coal to gas at these electricity and heat plants will also significantly improve air quality.

Increasing the use of photovoltaics by the city and residents will reduce the emission of electricity. By 2030, 100% of municipal buildings that have capacity for PV will have systems fitted.



## Emission inventories and climate action scenarios over a 30-year horizon

### C.2 Emission pathways. GCCAP Reduction Scenario for energy

#### Energy cont.

The city acknowledges that municipal buildings only represent around 10% of buildings citywide, therefore is committed to encouraging wider uptake among private and commercial property owners, aiming for 60% of all residential buildings by 2050, and 80% of commercial buildings to be fitted with systems, which would meet around 24% of total electricity demand of the city. Distributed renewables carry the additional benefit for residents of significantly reducing energy bills at a time when prices are at a record high, the city acknowledges the powerful role this strategy could have in reducing energy poverty, meanwhile increasing energy security.

As part of its efforts to reduce emissions from electricity, the City of Warsaw will also be switching its own electricity supply to a **renewable energy tariff**. The city is a significant consumer of electricity, representing an estimated 14% of total demand citywide. By implementing this as a short-term action, the city also hopes to encourage others to follow its lead by sourcing their electricity from renewables.



Photo: City of Warsaw

## Emission inventories and climate action scenarios over a 30-year horizon

### C.3 Emission pathways. GCCAP Reduction scenario for buildings

#### Buildings

A significant proportion of the city's greenhouse gas emissions come from the buildings sector, with building heating accounting for a particularly large share of these emissions. Improving the energy efficiency of buildings is important because of the reduction of greenhouse gas emissions, but also because of the costs incurred for electricity and heat consumption in buildings.

The city has identified four key strategies to tackle the buildings sector:

- Retrofit of existing stock
- Switching the sources of electricity and thermal energy in buildings to renewable energy and heat sources (including e.g. heat pumps),
- Construction standards for new buildings,
- Cooperation with owners of industrial and commercial buildings in the private sector in increasing the energy efficiency of these facilities.

These strategies are distinct yet intertwining and must be considered as a package, as none can exist effectively in isolation. For example, the city will replace the majority of existing gas boilers and coal-fired furnaces in the city with electric heat pumps by 2035 for all building types (powered

by an increasingly sustainable electricity supply), which will be complemented by a targeted retrofit program, targeting 36% of all buildings by 2035 and 81% by 2050 (with roof, window and wall insulation), that ensures a greater degree of energy efficiency to reduce energy consumption and subsequently bills for consumers. Achieving this GCCAP strategy will require the city to engage with residents, businesses, and raise finance for implementation.

Improving the energy efficiency of existing buildings is the biggest challenge for reducing greenhouse gas emissions in the city. At the same time, the city will implement the **Warsaw Green Building Standard** for new and retrofitted buildings.

Besides residential and commercial buildings, electricity consumption from manufacturing buildings, such as warehouses and data centers, are also significant contributors to citywide GHG emissions. As of 2022, there exists a knowledge gap in this area for the city, as comparatively little is understood about the activities behind these emissions compared to other sources. In order to reach its '40% by 2030' target, the city is setting a goal to increase energy efficiency in these buildings by 60% by 2035.



Photo: City of Warsaw

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## Emission inventories and climate action scenarios over a 30-year horizon

### C.4 Emission pathways. GCCAP Reduction Scenario for transport

#### Transport

**Transportation** emissions in the city are most significantly coming from on-road transportation, which is primarily diesel and gasoline passenger **vehicles (cars)**. The city is targeting two key strategies to reduce emissions from transportation:

- encourage residents to change their travel patterns and shift from car use to the use of public transport, bicycles, car and scooter sharing services, or walking,
- gradual replacement of city vehicles from internal combustion with electric and hydrogen-powered vehicles and encouraging private vehicle owners to take the same steps.

The results of the 2015 Warsaw Traffic Survey on urban transport, indicated a high proportion of passenger trips made by public transport - 46.8% compared to 31.7% by passenger **vehicles (cars)**.

The city is also taking steps to increase the use of non-motorised travel, aiming to increase the proportion of journeys made by bicycle, scooter and on foot by 50% by 2050. This will reduce car traffic in the city, at the same time leading to improvements in air quality and improving the health of residents who make use of more active modes of transport.

The national report by Kobize outlining decarbonisation of the transport sector establishes that in the most optimistic forecast, 12% of passenger cars could be EV and hybrid by 2030, and 64% by 2050.

Warsaw is setting an ambitious strategy target to double the implementation speed of this by 2030 with a focus on electrification, to achieve 24% of all passenger autos to be EV.

The city will need to collaborate with the private sector and other actors in order to install a wide-ranging charging network **and stations, and cooperate with private companies**, encouraging uptake from fleet operators and private owners **to implement charging stations**. The city is also a signatory to the C40 Green & Healthy Streets Declaration, by which it is committed to procure only zero-emission buses by 2025 and will have replaced the bus fleet with electric buses by 2050 or alternative zero/low emission (e.g., hydrogen). Warsaw is also taking steps to produce green hydrogen and create a network of hydrogen charging stations.

# Emission inventories and climate action scenarios over a 30-year horizon

## C.5 Extended Target Scenario

The latest evidence and analysis from the Intergovernmental Panel on Climate Change (IPCC) is clear that humanity must limit global warming to less 1.5 degrees in order to avoid the most disastrous impacts of climate change.<sup>42</sup> As already highlighted in Chapter 3, Warsaw faces a range of climate-related hazards, which would be exacerbated by climate change beyond this limit, including extreme weather, water shortages, heat waves and air pollution.

The City of Warsaw recognizes that this is not an arbitrary target, but a science-based upper limit of global warming, beyond which we breach irreversible tipping points. We acknowledge the need for steep emissions reductions and that we need to go even further and faster than is set out in our current **GCCAP Reduction Scenario**.

We are therefore setting an additional **aspirational target for 2030 of a 50% reduction** compared to 2018-level emissions (this equates to about a 54% reduction compared to 2007). However, we recognize that there is a range of regulatory and institutional barriers that will need to be overcome to meet this target.

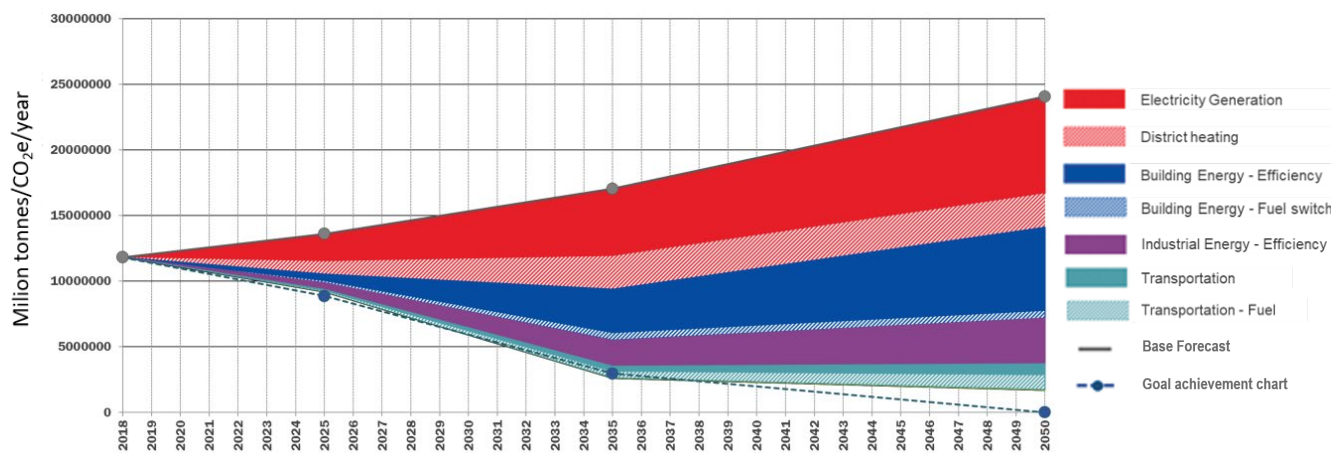


Figure 17. Warsaw's citywide GHG tonnes of emissions per year over the 4 horizon years in the model and how they grow (2018-2025-2035-2050) - potential of selected actions under 'Extended' scenario

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## Emission inventories and climate action scenarios over a 30-year horizon

### C.5 Extended Target Scenario

An additional objective of the Extended Scenario is to aim for a further reduction and a 54% reduction in CO<sub>2</sub> emissions by 2030 compared to 2007 (or 50% compared to 2018), in order to meet the climate targets that were established in the Paris Agreement (detailed information on the 2007 and 2018 inventories is described in chapter 3.3).

An ‘extended’ scenario has been developed to demonstrate, what changes need to be accelerated if we are to meet this aspirational target. This scenario will require even greater effort from the whole community and places greater emphasis on immediate action in four key areas:

- **Accelerating the retrofit of existing residential and commercial buildings to high energy performance standards.** This involves the assumption that all buildings requiring thermomodernisation will be subject to energy efficiency improvements by 2050. Meanwhile, in the **Reduction Scenario**, this figure is 81% by 2050. This will require finding new ways to influence private building owners, seeking changes to national legislation and overcoming the capital cost of such actions through innovative financing mechanisms.

- **More efficient installation of photovoltaics on buildings.** This is key to reducing CO<sub>2</sub> emissions associated with electricity consumed in the city. This can be achieved by doubling the rate of installation in the period up to 2035, so that 30% of all residential buildings are equipped with photovoltaic installations, rising to 60% by 2050. In the **Reduction Scenario**, the figure for residential buildings is 20% and for commercial buildings 30% by 2035. Achieving this target will require the removal of legal barriers or disincentives to the installation of solar PV in multi-family buildings. It will also be linked to the creation of an enabling regulatory environment to support the establishment of energy cooperatives. In addition, electricity distribution networks need to be strengthened to enable the connection of additional micro-installations.
- **Reducing the CO<sub>2</sub> intensity of grid-supplied electricity** is critical to unlocking the emission reduction opportunities associated with electric vehicles and electrification of heating buildings. In the **GCCAP Reduction Scenario** scenario coal still represents around half of the grid energy mix in 2035. To meet the extended scenario, coal must be phased out by 2035 and replaced with zero carbon generation.

This depends on national action and a “just transition” approach to avoid worsening the burden of energy expenditure on those least able to pay.

- **Limiting the role of gas as a transition fuel for district heating and seeking a faster decarbonisation of the district heating system.** The regional energy security and geopolitical context as of 2022 requires us to consider very carefully the role that natural gas plays in our transition to net-zero. Phasing out the use of all fossil fuels as quickly as possible and transitioning to zero carbon heat systems is a critical part of keeping the 1.5-degree global warming goal within reach, reducing the risk of stranded assets and tackling energy poverty.

## Emission inventories and climate action scenarios over a 30-year horizon

### C.5 Extended Target Scenario

In practice, reducing the role of gas is likely to require a systems approach that acknowledges the role of different technologies and sources of heat and requires coordination with a range of stakeholders. In the short term, this will be supported by the development of a zero-carbon roadmap for the building and heat system working with stakeholders in the energy sector including PGNIG.

Even with a completely renewable supply of heat and electricity, the city still has residual emissions to carbon neutrality of 1.7m tCO<sub>2</sub> in 2050 (14% of 2018-levels), primarily coming from sources independent of the city, such as a small amount of remaining users of gasoline and diesel vehicles and some remaining gas cooking stoves. The city is committed to compiling GHG inventories at least every two years, based on data no older than three years, as well as re-evaluating the options to address these residual emissions as part of future plan updates.

**Table 28. Additional Extended Scenario strategies**

Sector	Theme	Strategy goals	Barriers to implementation
Buildings	Existing buildings - retrofits	All buildings with whole house retrofit (window, roof, wall insulation, replacing internal heating systems in buildings to low temperature) by 2050	Legal & institutional Financial & economic Political & social Practical & technological
Energy	Distributed renewables (PV)	30% of all residential buildings fitted with solar PV by 2035	Legal & institutional Financial & economic Practical & technological
Energy	Grid decarbonisation	No coal in the grid energy mix by 2035	Legal & institutional Financial & economic Political & social Practical & technological
Energy	District heating	Avoiding gas as a transition fuel	Legal & institutional Financial & economic Political & social Practical & technological

## Emission inventories and climate action scenarios over a 30-year horizon

### C.6 Extended Scenario. Analysis of barriers

**Table 29. Barriers analysis for buildings retrofit scheme strategy**

Extended strategy name	Expanded buildings retrofit scheme
<b>Strategy description</b>	Buildings retrofit is one of the most significant strategies in Green City and Climate Action Plan of Warsaw Planning, due to the high amount of emissions coming from residential and commercial buildings in the city's GHG inventory.
<b>Assumptions</b>	In the <b>Warsaw's GCCAP Reduction Scenario</b> and the Ambitious scenario, the city is planning for 36% of all citywide residential and commercial buildings to be retrofitted by 2035, and 81% by 2050, which was identified as the most ambitious yet feasible amount. In the <b>Extended scenario</b> , 100% by 2050 could be achieved if there is a possibility to overcome the following barriers.
<b>Barrier</b>	<b>Description of Barrier</b>
<b>Legal &amp; Institutional</b>	City has no legal power to influence the private (developers, housing cooperatives) owners to invest in building retrofit. The City can only try to influence the private owners by incentives and by showing the inhabitants best practices to help them encourage the changes. The City could also lobby for some changes on the national level in the Building Law and in the housing cooperatives law.
<b>Financial &amp; economic</b>	Cost of full retrofit of buildings is very high and exceeding the available city budget. Private owners of single households may be interested in co-financing from some funds as they can lower the costs of used energy.
<b>Political &amp; social</b>	Currently, subsidies are mainly granted to wealthy and middle-class residents (e.g. subsidies for the installation of PV panels). This phenomenon is related to the fact that the level of subsidies is insufficient and only a part of the population with a higher income can afford RES investments. Further subsidies will have to be extended to energy poverty households.
<b>Practical &amp; technological</b>	Retrofit will need to include a change in entire solutions in the buildings (insulation, heating system, ventilation). Buildings with low energy efficiency are often block of flats at least 30 years old, which are technically not suitable for the low heat installation.

## Emission inventories and climate action scenarios over a 30-year horizon

### C.6 Extended Scenario. Analysis of barriers

**Table 30. Barriers analysis for the faster installation of solar PV strategy**

Extended Strategy Name	Faster installation of Solar PV
<p><b>Strategy description</b></p> <p><b>Assumptions</b></p>	<p>In the <b>Extended Scenario</b>, the city is planning for 60% of all citywide residential buildings and 80% of commercial buildings to be fitted with distributed renewables (solar PV) by 2050, which can meet a significant proportion of the city’s total electricity demand.</p>
Barrier	Description of Barrier
<p><b>Legal &amp; Institutional</b></p>	<ul style="list-style-type: none"> <li>• Installation and use of solar panels on a single-family house is easy and uncomplicated. It gets much more difficult on multi-family buildings – the current law allows on installation solar panels on them, but only for the needs of supplying energy for common areas (elevators, lighting in corridors). Supplying energy for individual residents would require connecting the installation to electricity meters of each apartment, which in fact is too complicated and effectively discourages most of the people. For already some time the government has been working on changing this law, however so far nothing seems to be coming up in the near future.</li> <li>• From April 2022 on the new law on prosumers came into force. The current law contributed to immense expansion of photovoltaics in Poland in recent years, thanks to central and local governments’ subsidies, but also due to very favourable rules of energy exchange with the grid. It allowed to transfer energy surpluses from micro-installations to the grid and to transfer it back when necessary (i.e. at night or in cloudy days). The new law will allow to sell energy surplus to the grid for average prices, but prosumer will have to buy it for average prices when his installation doesn’t produce sufficient energy. It is probable that selling prices for prosumers will be significantly lower than buying prices (energy prices might peak during winter). This discourages individual citizens from investment – solar panels will not be so profitable.</li> <li>• Due to the current regulations energy cooperatives are only allowed in rural and rural-urban communes, while urban communes, like Warsaw, cannot develop such solutions which might enhance small-scale energy generation.</li> </ul>



## Emission inventories and climate action scenarios over a 30-year horizon

### C.6 Extended Scenario. Analysis of barriers

**Table 30. Barriers analysis for the faster installation of solar PV strategy**

Extended Strategy Name	Faster installation of Solar PV
<b>Financial &amp; economic</b>	<ul style="list-style-type: none"> <li>Warsaw offers its residents subsidies for renewable energy installations. The city relies mainly on its own budget: in 2021, 1,060 investments worth PLN 12.5 million were subsidised, mainly in solar panels. Individual investments have also been supported by funds from the state budget, as part of a government subsidy programme. However, these funds are not sufficient to meet the ever-growing needs of the population.</li> </ul>
<b>Political &amp; social</b>	<ul style="list-style-type: none"> <li>Not all the roofs can be easily adapted for the needs of installation of solar panels. Firstly, it is necessary to perform analyses and in some cases, it might be required to rebuild roofs, which might be costly, leading to significant increase of the total investment value.</li> <li>Efficiency of solar panels is still too low, however in terms of price/efficiency ratio it gets much better thanks to the growing supply of solar panels from China. Still, it is crucial to develop new technologies, which might significantly increase efficiency of solar panels – for example by developing solutions based not on silicon, such as perovskite.</li> <li>The national energy grid needs significant modernization. Its quality and efficiency is very low and very often it is not able to receive/ collect energy produced by prosumers and other micro-installations – which makes these installations useless and unproductive.</li> </ul>

## Emission inventories and climate action scenarios over a 30-year horizon

### C.6 Extended Scenario. Analysis of barriers

**Table 31. Barriers analysis for the national grid energy mix with 0 coal by 2035**

Extended Strategy Name	National grid energy mix with 0 coal by 2035
<b>Strategy description/ Assumptions</b>	<p>In 2018, Poland’s electricity grid energy mix is heavily dependent on coal. “Poland Energy Outlook 2040” (used for the ‘Existing and Planned scenario) forecasts that coal will still represent around half of its current (2018) proportion of electricity energy mix by 2040, however this is still around a third of the overall energy mix.</p> <p><b>In the GCCAP</b> the ‘Ambitious’ scenario is aiming for 0 coal in the electricity grid energy mix by 2050. However, coal still represents around half of the grid energy mix in 2035, which is a significant contributor to emissions. Furthermore, according to the IEA’s ‘net-zero by 2050’, unabated coal should be phased out in advanced economies by 2030, with net zero emissions from electricity by 2035.</p> <p>In the ‘Extended’ scenario, a complete phase out of coal from the national electricity grid could be achieved with action to overcome the following barriers.</p>
Barrier	Description of Barrier
<b>Legal &amp; Institutional</b>	<ul style="list-style-type: none"> <li>• The new law on prosumers – explanation under Legal and institutional barriers in Table 29 (heading: Faster photovoltaic installation).</li> <li>• On-shore wind energy – development of new installations was significantly disrupted due to the ‘Distance law’ on wind energy units, which came in force in 2016. New regulations implemented the rule of 10H – distance of wind turbines from houses had to be at least ten times the height of turbine. Currently the government is working on amendment of this law in order to loose these regulations. It was announced that the amendment would be voted in the parliament in Q1 2022, however details are yet unknown.</li> </ul>
<b>Financial &amp; economic</b>	<p>The pace of transition towards zero-emission energy in Poland is too slow. Admittedly, in recent years energy companies have stopped investments in coal power units (the last huge investments took place in Jaworzno power plant in 2020 and in Turow power plant in 2021) and they no longer plan on development or redevelopment of existing units, but Poland is likely to fall into a ‘gas trap’. Most of new investment in energy sector are streamed into gas power plants, which will slow down the pace of decarbonisation for decades – until these new developments end their existence or new, more effective energy sources are developed and more viable than gas.</p>

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## Emission inventories and climate action scenarios over a 30-year horizon

### C.6 Extended Scenario. Analysis of barriers

**Table 31. Barriers analysis for the national grid energy mix with 0 coal by 2035**

Extended Strategy Name	National grid energy mix with 0 coal by 2035
<b>Political &amp; social</b>	<p><b>Political</b></p> <p>The very strong pressure from the mining industry (mostly state-owned mining companies) and the trade unions associated with this sector may have the effect of limiting the placement of investments in renewable energy sources. These stakeholders do not consider the fact of growing emission tax and tend to focus on short-term perspective. Energy transition is seen as a cost and a threat to employment in traditionally mining regions, such as Upper Silesia. These factors make it very hard to speed up the decarbonization of the national energy mix.</p> <p><b>Social</b></p> <p>The use of coal in national energy mix depends mostly on political decisions, but these depend on social support. In some groups coal is perceived as the most stable and trustworthy energy source, much more than renewable energy. Coal is also treated as the fundament of the country's energy security, putting aside the fact that Poland already imports significant amounts of coal from countries like Australia, USA or Colombia.</p>
<b>Practical &amp; technological</b>	<p>Currently Poland lacks technology which might effectively replace coal as the stable base of energy system. Energy companies are investing in gas-fired units instead of focusing on renewable energy due to the high costs associated with building energy storage facilities. The plan of development of nuclear power plant is under way, however its impact on decarbonization will be delayed, because the first nuclear power unit is planned to be launched in 2033, while full launch is planned on 2043 (6-9 GW).</p>

# Appendix D

Public consultation



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## Public consultation

As mentioned in Chapter 2 of this document, the Green City Action and Climate Plan was submitted to consultation with a wide range of local stakeholders. At each stage of project development, residents were informed and enabled to make comments on the project by using the Virtual Engagement Room.

During the development of the document in 2021, there were also workshops on the importance of the challenges and a workshop on the list of actions.

The last important step in the development of the document was a organised, formal public consultation, where again all citizens were able to submit their comments and observations.



Photo: Ludwika Ignatowicz. Meeting at the Kamień Education Pavilion

## Public consultation

As part of the public consultation, we organised a meeting at the Kamień Education Pavilion, where we discussed with 14 people, representing different age and social groups, with a common characteristic among the participants was a concern for environmental protection and the pursuit of climate neutrality in the city.

The discussions took place at a relatively high level, with a significant engagement, and the topics raised were analysed in an in-depth way - the best solutions were sought together. Participants had their demands and thoughts ready, but only 4 people had read the document before the meeting.



Photo: Ludwika Ignatowicz. Meeting at the Kamień Education Pavilion

## Public consultation

During the public consultation process, we collected data by using an online survey and a paper questionnaire, which included questions about the extent to which respondents' expectations were in line with the solutions proposed in the document. The paper questionnaire was available, along with a printout of the document, at the Widok Towers building. Respondents were also asked to evaluate the project, suggest additions and changes to the document and provide comments on the presented actions.

215 questionnaires were received, including:

- 68 general comments (7 only in terms of evaluation
- scoring),
- 54 comments were accepted and 17 partially accepted,
- 76 comments were rejected.

The comments were diverse and covered many sectors of the city. Substantive comments predominated, but some were beyond the scope of the study.

Respondents included residents, sometimes anonymously, and representatives of public benefit organisations and the public sector.

## W DRODZE DO NEUTRALNOŚCI KLIMATYCZNEJ

Ukończono 0%

### Strona 1

1. Czy zgadzasz się z rozwiązaniami zaproponowanymi w tym dokumencie?

- Zdecydowanie się nie zgadzam
- Raczej się nie zgadzam
- Ani się zgadzam ani nie zgadzam
- Raczej się zgadzam
- Zdecydowanie się zgadzam

Czy format tego pytania sprawia Ci trudności? [Zobacz wersję bez tabelki](#)

2. Jak oceniasz zgodność tego dokumentu ze swoimi oczekiwaniami wobec działań miasta w zakresie zrównoważonego rozwoju?

Działania wymienione w dokumencie nie spełniają moich oczekiwań	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Działania wymienione w dokumencie przekraczają moje oczekiwania
---	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	---

3. Czy Twoim zdaniem coś zostało pominięte w tym dokumencie? Jeżeli tak – wskaż pominięte kwestie poniżej.

Odpowiedź nie powinna zawierać więcej niż 2000 znaków

Photo: Screenshot from online survey

## Public consultation

Residents were informed of the public consultation through:

- Warsaw Public Consultation Platform website (um.warszawa.pl),
- Social media,
- Media in public transport,
- Press.

The comments that were received in written form, together with comments on how they could be incorporated into the document, are attached to the consultation report.

Accepted comments have been incorporated into the document.

Some of the general comments, which do not directly concern the Green Vision for Warsaw and the document's goals, have been or will be forwarded to the appropriate units and entities of the Warsaw City Hall.

Adoption of the document is planned for the first half of 2023, after which detailed planning and implementation of the actions included in it will begin.



Photo: Part of a spot presented on public transport



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